EIGHT GRADE STUDENTS' PERCEPTIONS OF THEIR SCIENCE LEARNING ENVIRONMENT AND TEACHERS' INTERPERSONAL BEHAVIOR

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Approval of the Graduate School of Natural and Applied Sciences.

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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ABSTRACT

EIGHT GRADE STUDENTS'
PERCEPTIONS OF THEIR SCIENCE LEARNING ENVIRONMENT
AND TEACHERS' INTERPERSONAL BEHAVIOR

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This study aimed to explore the students perceptions of science learning environment and teachers' interpersonal behavior, and the relationships of these with students' cognitive and affective outcomes. In this study, the Questionnaire on Teacher Interaction (QTI), the What is Happening In This Class (WIHIC) questionnaire and the Science Attitude scale were used as measuring instruments.

This study was conducted in conveniently selected 5 schools throughout the Yenimahalle district of Ankara with a total of 722 eighth grade students in the second term of 2003-2004 semester. Data obtained from the administration of the measuring instruments were analyzed by using the analysis of variance (ANOVA), multivariate analysis of variance (MANOVA), multiple regression, bivariate correlations and multiple regression.

Results indicated that the students generally perceived a positive science classroom learning environment in Turkey. Students perceived that their teachers displayed cooperative behaviors (leadership, helping / friendly, and understanding) rather than opposition behaviors (uncertain, dissatisfied, and strict) in terms of interaction with them. In addition, analysis indicated that there is relationship between students perceptions of classroom environment (learning environment and teacher interpersonal behavior) and students' cognitive and affective outcomes. Moreover, data indicated that girls rated their learning environment and teacher interpersonal behavior more favorably than do boys. Lastly, students viewed science learning environment of their male teachers' classes more cooperative than female teachers' classes and students rated their male teachers that display more strict behavior than female teachers.

Keywords: Learning environment, teacher interpersonal behavior, achievement, attitudes, student and teacher gender.

ÖZ

SEKİZİNCİ SINIF ÖĞRENCİLERİNİN FEN BİLGİSİ DERSİ ÖĞRENME ORTAMI VE ÖĞRETMEN İÇSEL DAVRANIŞ ÖZELLİKLERİNİ ALGILAMALARI

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Bu çalışmanın amacı, sekizinci sınıf öğrencilerinin sınıf öğrenme ortamını ve öğretmenin içsel özelliklerini algılamaları ve bunların öğrenci başarısı ve derse olan tutumları arasındaki ilişkiyi araştırmaktır. Bu çalışmada veri toplama araçları olarak, öğretmen etkileşim anketi, bu sınıfta neler oluyor anketi ve fen bilgisi tutum anketi

kullanılmıştır.

Bu çalışma, Yenimahalle İlçesinden seçilen 5 okuldaki 722 öğrenciye 2003-2004 eğitim yılının 2. döneminde uygulanmıştır. Toplanan veriler varyans analizi (ANOVA), çok yönlü varyans analizi (MANOVA), basit ilişki analizi ve çoklu regresyon analizi kullanılarak değerlendirilmiştir.

Sonuçlar, sekizinci sınıf öğrencilerin fen bilgisi dersi öğrenme ortamını genelde olumlu olarak algıladıklarını göstermiştir. Öğrenci-öğretmen etkileşimi açısından öğrenciler, öğretmenlerinin zıt (belirsiz, memnuniyetsiz, ve katı / disiplinli) davranışlardan ziyade işbirlikçi (liderlik, yardımcı / arkadaşça ve anlayışlı) davranışlar gösterdikleri sonucuna varmışlardır.

Analizler, öğrencilerin sınıf ortamını (öğrenme ortamı ve öğretmen içsel özellikleri) algılaması, öğrenci başarısı ve fen dersine yönelik tutumu arasında bir korelasyon olduğunu göstermiştir. Ayrıca, kız öğrencilerin sınıf ortamını ve öğretmen içsel özelliklerini erkek öğrencilerden daha olumlu olarak algıladıkları gözlemlenmiştir. Buna ek olarak, öğrenciler, erkek öğretmenlerin sınıf öğrenme ortamının bayan öğretmenlerinkinden daha işbirlikçi olduğunu ve erkek öğretmenleri bayan öğretmenlere göre daha sert görmüşlerdir.

Anahtar Kelimeler: Öğrenme ortamı, öğretmen içsel özellikleri, başarı, tutum, öğretmen ve öğrenci cinsiyeti.

To My Parents

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DV	: Dependent Variables
IV	: Independent Variables
ANOVA	: Analysis of Variance
MANOVA:	: Multivariate Analysis of Variance
SD	: Standart Deviation
SA	: Science Achievement
QTI	: Questionnaire on Teacher Interaction
DC	: Leadership scale of QTI
CD	: Helping/friendly scale of QTI
CS	: Understanding scale of QTI
SC	: Responsibility/freedom scale of QTI
SO	: Uncertain scale of QTI
OS	: Dissatisfied scale of QTI
OD	: Admonishing scale of QTI
DO	: Strictness scale of QTI
WIHIC	: What is Happening in This Classroom?
ST	: Student cohesiveness scale of WIHIC

	TS	: Teacher support scale of WIHIC
	IV	: Involvement scale of WIHIC
	IN	: Investigation scale of WIHIC
	TO	: Task orientation scale of WIHIC
	CO	: Cooperation scale of WIHIC
	EQ	: Equity scale of WIHIC
N		: Sample Size
α		: Significans Level

CHAPTER I

INTRODUCTION

Learning enviroment has been investigated by many researchers for many years. Past researches (Fraser, 1986, 1994, 1998 a, b, Fraser & Walberg, 1991) show that the learning environments has been used as a source of dependent and independent variables in a rich variety of research applications, spanning many countries.

School is a social system in which educational outcomes result when inputs from external environment are transformed by the school internal environment. The internal environment is the context of learning and consists of the physical environment and the psychological environment. The physical environment of the school and the classroom – facilities, spaces, lightening, ventilation, desks and chairs, and air pollution – affect the safety and comfort of students and thereby affect learning and personal development. The psychological environment refers to the social quality of the school and classroom, especially as it relates perceptions and feelings about social relationships among students and teachers. The terms classroom psychological environment, classroom atmosphere, classroom social climate, classroom social interactions, and classroom social relationship are often used interchangeably when scholars discuss the classroom learning environment (Cheng, 1994).

The classroom is the basic structural unit of educational system. This environment is where a wealth of interactions occurs among students, teachers, peers, and curriculum and is where learning takes place. These interactions create an environment that affects both attitudes and achievement of students.

Learning environment research has grown out of the studies of Rudolf Moos (Moos, 1968, 1974, Moos & Trickett, 1987) and Herbert Walberg (Anderson and Walberg, 1974) since the late 1960s and early 1970s. These studies provided a base for a large number of studies on learning environment, which have been well documented in various books (Fraser, 1986, Fraser & Walberg, 1991) and literature reviews (MacAuley, 1990, Fraser, 1994). Classroom and school environment factors were found to be particularly important influences on student outcomes, even when a number of other factors were controlled. This has been addressed by many researchers (Moos, 1980, Keyser & Barling, 1981, Wright & Cowen, 1982, Fraser, 1986). Fraser (1986) asserts that the environment and its interaction with personal characteristics of individual are potent determination of human behavior.

Numerous researchers have investigated the classroom as a learning environment for many years. In the past, the most common means of measuring the learning environment has been through the use of observations: that has led to insights into the learning environment through the eyes of the participants or the eyes of an external observer, rather than through the eyes of the students. But researchers have indicated that students' and teachers' perceptions are important parameters to the social and psychological aspects of the learning environments of school classrooms (Fraser, 1986,

1994, 2000).

The critical component of the classroom is heavily influenced by the interpersonal skills of a teacher (Creton, Wubbels, & Hooymayers, 1989). It assumed that a productive and stable classroom atmosphere is at the heart of teaching effectiveness, and that the quality of the climate is dependent on the nature of the teacher-student communication (Levy, Wubbels, & Brekelmans, 1992). Reaserch has shown that students' perception of their teachers interpersonal behavior is an important factor in explaining their cognitive and affective outcomes (Wubbels, Brekelmans, & Hooymayers, 1991, Goh & Fraser, 1998, Henderson, Fisher & Fraser, 2000, Den Brok, 2001, Brekelmans, Wubbels, & Den Brok, 2002, Scott, Den Brok & Fisher, 2004)

Learning environment researches, which were firstly started in Western countries, showed strong emphasis on the use of a variety of validated questionnaires that assess students' perceptions of their classroom learning environment. Later, researches on learning environment were begun in Asia countries. Asian researchers have completed numerous impressive studies that have cross-validated the main contemporary classroom environment questionnaires (e.g. Questionnaire on Teacher Interaction, Science Laboratory Environment Inventory, Constructivist Learning Environment Survey, and What Is Happening In This Class?) that were originally developed in English. Asian researchers also have undertaken painstaking translations and have validated these questionnaires in the Chinese, Indonesian, Korean and Malay languages. However, no studies have been found investigating learning environment in Turkey. Past studies in this area reported that learning environment can be a

determinants of students' achievement and their attitudes and should be taken into account. For that reason, there is a great need for conducting research in the domain of learning environment in Turkey. Fraser (1986) mentioned that the classroom environment is such a potent determinant of students' outcomes that it should not be ignored by those wishing to improve the effectiveness of schools. Accordingly, the present study investigated two aspects of classroom environment-learning environment and interpersonal teacher behavior- in science classrooms in Turkey. The purpose of this study was to investigate 8 th grade students' perceptions of their science learning environment and teachers' interpersonal behavior, and their association with students' affective and cognitive outcomes using a paper-and-pencil perceptual measures. This study will provide suggestions for both researchers in practice and teachers.

1.1 The Main Problem and Sub-problems

1.1.1. Main Problem

The purpose of this study was to investigate 8 th grade students' perceptions of their science learning environment and teachers' interpersonal behavior, and their association with students' affective and cognitive outcomes in Ankara.

1.1.2. Sub-Problems

The following sub-problems were investigated based on the main problem;

1) What are the 8 th grade elementary school students' perceptions of science learning environments?
    a. Are there any significant relationships between the 8th grade students' attitudes towards science and their perceptions of science learning environment?
    b. Are there any significant relationships between the 8th grade students' science achievement and their perceptions of science learning environment?
    c. Are there any significant difference between the 8th grade boys and girls with respect to their perceptions of science learning environment?
    d. Are there any significant difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of science learning environment?
2) What are the 8 th grade elementary school students' perceptions of their science teacher interpersonal behavior?
    a. Are there any significant relationships between the 8th grade students' attitudes toward science and their perceptions of their science teacher interpersonal behavior?
    b. Are there any significant relationships between the 8th grade students' science achievement and their perceptions of their science teacher interpersonal behavior?

c. Are there any significant differences between the 8th grade boys and girls with respect to their perceptions of their science teacher interpersonal behavior?

d. Are there any significant difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of their science teacher interpersonal behavior?

1.2 Null Hypothesis

The problems stated above were tested with the following hypothesis.

Null Hypothesis 1 : There is no significant relationship between the 8th grade students' attitutes towards science and their perceptions of science learning environment.

Null Hypothesis 2 : There is no significant relationship between the 8th grade students' science achievement and their perceptions of science learning environment.

Null Hypothesis 3: There is no significant difference between the 8th grade boys and girls with respect to their perceptions of science learning environment.

Null Hypothesis 4 : There is no significant difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of science learning environment

Null Hypothesis 5 : There is no significant relationship between the 8th grade students' attitudes toward science and the students' perceptions of their science teacher interpersonal behavior.

Null Hypothesis 6: There is no significant relationship between the 8th grade students' science achievement and the students' perceptions of their science teacher interpersonal behavior.

Null Hypothesis 7: There is no significant difference between the 8th grade boys and girls with respect to their perceptions of their science teacher interpersonal behavior.

Null Hypothesis 8: There is no significant difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of their science teacher interpersonal behavior.

1.3 Definitions of Important Terms

This section includes some important definitions related to the study.

8 th grade : Third year in junior high school.

Interpersonal teacher behavior (Teacher communication style) : Communication processes is assumed that the behaviors of participants influence each other mutually. When we adapt this theory for classroom; the behavior of the teacher is influenced by the behavior of the students and in turn the teacher's behavior influences student behavior. In consequence a circular communication process based upon interacting behaviors develops. Interpersonal teacher behavior means the interactions that occurred between teachers and students.

Science Learning Environment : It is the combination of the physical and social environment of the science classes.

Attitude Towards Science : Students' affective behaviors (e.g., prefer, accept, appreciate, and commit) toward science.

Science Achievement : Students' previous semester science grades over 5.

1.4 Significance of the study

Classroom learning environment refers to a space or a place where learners and teachers interact with each other and use a variety of tools and information resources in their pursuit of learning activities (Wilson, 1996). The nature of the classroom environment and psycho-social interactions can make a difference in how the students learn and achieve their goals (McRobbie, Roth, & Lucus, 1997).

The association between student perceptions of learning environment variables and students' affective and cognitve outcomes have provided a particular rationale for the use of learning environment instruments. Studies consistently have shown evidence of associations between student perceptions of their classroom learning environment and student outcomes, even when other variables such as student ability were controlled (Fraser, 1994, Haertel, Walberg, & Haertel, 1981). Students learn better when they perceive the classroom environment positively (Chionh & Fraser, 1998). Similarly, there is a positive association between perceptions of learning environment and attitudinal outcomes (Hunus & Fraser, 1997, Rawnsley & Fisher, 1998, Myint & Goh, 2001).

Although research in learning environment in Western countries and in some developing countries has grown rapidly, this did not occur in Turkey. There have been a limited number of studies about learning environment in Turkey. No study has yet been conducted about interpersonal teacher behavior in Turkey. This study adds to the growing body of research into learning environment, generally, as well as, to the beginning of learning environments specifically in Turkey. Overall this research made numerous distinctive contributions to the field of learning environment research in

Turkey. For the first time, Turkish version of the Questionnaire on Teacher Interaction (T-QTI) was developed, validated, and used in research applications. This study is the first learning environment research done on interpersonal teacher behavior in Turkey.

Because of lack of investigations on science learning environment and teachers interpersonal behavior in Turkey, this study provided insight into science classroom environment in Turkey through the eyes of the students. It informs the science educators about the status of science classroom learning environments and eduactional practices in Turkish upper elementary schools. This study also help principles and teachers to improve their science education and assists classroom teachers to enhance their classroom learning environment. Understanding students' perception of their classroom learning environment and teachers interpersonal behaviors and the factors associated with their perception may help science educators and teachers to find out some alternative ways that enhance the students learning and atttitudes.

CHAPTER II

REVIEW OF RELATED LITERATURE

Classroom learning environment refers to a space or a place where learners and teachers interact with each other and use a variety of tools and information resources in their pursuit of learning activities (Wilson, 1996). The learning environment has a strong influence on student outcomes and plays an important role in improving the effectiveness of learning from the level of the institution to the level of the individual classroom. Learning environment researches offer investigators insight into what goes on in school and university educational settings beyond the notation of student achievement. The main points explained in this chapter are theoretical framework for learning environment, instruments used to investigate the learning environment and researches involving learning environment instruments.

2.1 Theoretical Framework for Learning Environment

Learning environment has been investigating by many researchers for many years. Very first studies were done by Hartshorne and May (1928) and Newcomb (1929). They similarly noted that student behavior could be altered by the environment.

Hartshorne and May verified that personality traits were poorly correlated to students' tendency to participate in deceitful behavior, such a cheating on exams, given the opportunity in differing situations. Newcomb noted that students' talkativeness during lunch periods was a highly stable trait; however, the same trait did not carry over to other situations.

A couple of years later another researcher, Lewin (1936) recognized that both the environment and its interaction with personal characteristics of the individual are the potent determinants of human behavior. The Lewinian formula, B= f (P, E), describe human behavior (B) as a function of two interdependent influences, the person (P) and the environment (E). Murray (1938) was the first worker to follow Lewin's approach by proposing a need-press model, which allows the analogous representation of person and environment in common terms. Personal needs refer to motivational personality characteristics representing tendencies to move in the direction of certain goals: environment press provides an external situational counterpart that supports or frustrates the expression of internalized personality needs.

Later the researchers head towards to investigate the effects of the psychosocial learning environments and their influences on student outcomes. Walberg and Moos, independent of one another, began considering psychosocial environments and their influences on student outcomes in the late 1960s and early 1970s. Their work can be considered the "starting points for contemporary learning environment research" (Fraser, 1990, p. 201) that "took off in the 1970s" (Tobin, 2000, p. 223).

In the 1970s, Rudolph Moos, attributed increased awareness and action related to the natural environment to an upsurge of interest in human environment researches. He noted that human ecologists became concerned with the way people grow and adapt in their environments and those psychologists and sociologists became more concerned with creating environments that led to the maximization of human functioning and competency (Moos, 1976). Moos had been studying psychosocial environments for over a decade when he put forward "five different, yet related, conceptions of how the environment works" (p. 29). These conceptions were:

1. from the perspective of evolution and human ecology, that environments can be limiting on the actions of people;
2. from the perspective of social Darwinism, that environments choose, or favor, people by those with stronger characteristics;
3. that environments motivate and challenge individuals, facilitating individual and social growth in terms of the development of civilizations;
4. from a social ecological approach, that individuals seek information about environments in order to select those with the greatest probability for success; and
5. that individuals seek increase their control over environments in order to increase individual freedom.

The integration of these five concepts led to the development of the perspective Moos termed "a social ecological approach" (p. 28) designed to comprehend the influence one's environment has from the viewpoint of the individual and to enhance our

environments to enrich the quality of life.

From this perspective, Moos (2002) described organizational environment system domains in social ecology that can depict infinitely different environments in terms of three dimensions:

1. the Relationship Dimension
2. the Personal Growth Dimension
3. the System Maintenance and Change Dimension.

From subsequent work, Moos has been able to demonstrate the enduring quality of these dimensions in terms of family, work, school, health, military, prison and community social contexts (Moos, 1976, 1979, 2002). The Relationship Dimension distinguishes the nature and strength of personal relationships. This is the extent to which people work with one another and support and assist one another. Terms related to this dimension include: cohesiveness, expressiveness, support, involvement, affiliation, and involvement. Personal Development is characterized by personal growth and self-enhancement opportunities offered by the environment. Terms related to this dimension include: independence, achievement, task orientation, self-discovery, anger, aggression, competition, autonomy, and personal status. System Maintenance and Change considers the degree of control of the environment, the orderliness, clarity in expectations, and responsiveness to change. Terms characterizing this dimension include: organization, control, order, clarity, innovation, physical comfort, and influence (Moos, 1976).

It is through the framework of these dimensions that investigators can characterize and integrate the impacts social environments have on individuals and groups. Psychosocial environments tend to preserve the individual characteristics that are compatible with their prevailing aspects (Moos, 2002). When participants in an environment are offered information about their environment, opportunities for adaptation to the environment can affect the participant's expectations of the social milieu. Further, given information about the social climate of an environment, participants have potential opportunities to alter their environment positively to promote productivity within it. Likewise, when stakeholders participating in an environment are supplied with information on what is an ideal environment, they can use that information to shape their own toward the goal of making it an ideal environment. "Practical applications of the concept of social climate," such as in school settings, "make it one of the most exciting and potentially useful ways of characterizing environments" (Moos, 1976, p. 352).

The field of learning environments has undergone remarkable growth, diversification and internationalization during the past 30 years (Fraser, 1998, a). There are three common approaches to studying learning environment involving systematic observations, case study, and assessing student and teacher perceptions. Student and teacher perceptions are assessed with paper-and-pencil perceptual measures. There are some important advantages of paper-and-pencil perceptual measures. Thus, they are used more widely. First of all, paper-and-pencil perceptual measures are more economical than classroom observation techniques which involve the expense of trained

outside observer. Another advantage is that they are based on students' experiences over many lessons, while observational data usually are restricted to a very small number of lessons. Also perceptual measures involve the pooled judgments of all the students in a class, whereas observational techniques typically involve only a single observer. Students' perceptions, because they are the determinants of student behavior more so than the real situation, can be more important than observed behaviors. Lastly, perceptual measures of classroom environment typically have been found to account for considerably more variance in student learning outcomes than have directly observed variables (Fraser and Walberg 1991). Students have a good vantage point to make judgment about classrooms because they have encountered many different learning environments and have enough time in class to form accurate impressions. Also, even if teachers are inconsistent day-to-day behavior, they usually project a consistent image of the long-standing attributes of classroom environment. Thus, a striking feature of this field is the availability of a variety of economical, valid and widely-applicable questionnaires that have been developed and used for assessing students' perceptions of classroom environment (Fraser, 1998, b). A brief explanation about some of the questionnaires is written in the next section.

2.2 Learning Environment Research Instruments

There has been a "prolific development of questionnaires" (Tobin, 2000, p. 223) in the field of learning environment researches and investigators are able to select salient scales and the items within those scales to conduct their own studies without having to independently construct new instruments. The following section presents an abbreviated look at a few of the instruments that are available today for face-to-face learning environment research.

Early questionnaires include the Learning Environment Inventory (LEI), and the My Class Inventory (MCI). The LEI assumes that students, as well as the teacher, are determinants of the learning environment (Anderson & Walberg, 1974). The MCI is a simplified version of the LEI, adapted for use with younger children aged 6-12 years. Meanwhile, the College and University Classroom Environment Inventory (CUCEI) focused exclusively upon perspectives at the post-secondary level (Fraser, Treagust, & Dennis, 1986). Individualised Classroom Environment Questionnaire (ICEQ) distinguishes individualised classrooms from conventional ones (Rentoul & Fraser, 1979).

Instruments that are more contemporary are numerous and ever growing. They include: the Science Laboratory Environment Inventory (SLEI) geared toward upper secondary and post-secondary students (Fraser, Giddings, & McRobbie, 1992); the Constructivist Learning Environment Survey (CLES) aimed at secondary students (Taylor, Fraser, & Fisher, 1997) and Classroom Environment Scale (CES) considered teacher behavior, teacher-student interaction and student-student interaction (Moos,

1979). The Computer-Facilitated Learning (CFL) environments instrument was developed for use in technology-rich university courses (Bain, McNaught, Mills & Luedkenhausen, 1998). The What Is Happening in this Classroom? (WIHIC) instrument focuses on secondary classrooms and was designed to bring economy to the field by combining the most relevant scales from existing questionnaires (Aldridge, Fraser, & Huang, 1999). The Questionnaire on Teacher Interaction (QTI) focuses on the interpersonal relationships between students and their mathematics and science teachers (Wubbels, 1993).

A distinctive feature of most of the instruments is that they have not only a form to measure perceptions of actual classroom environment but also a form to measure perceptions of preferred classroom environment. The preferred (or ideal) forms are concerned with goals and value orientations and measures perceptions of the classroom environment ideally liked or preferred. Although items wording is identical or similar for actual and preferred forms, instructions for an answering are different. For example, an item in the actual from such as 'There is a clear set of rules for students to follow' would be changed in the preferred to 'There would be a clear set of rules for students to follow'.

Table 2.1 (Fraser, 1998, b) gives information about nine major instruments namely; LEI, ICEQ, CES, CUCEI, MCI, SLEI, QTI, CLES and WIHIC. The level of instruments, item per scale, and scale classification were listed. Scales are classified according to Moos's Scheme.

Table 2.1 Overview of scales contained in nine learning environment instruments

Instrument	Level	Items / scale	Relationship dimensions	Personal development dimensions	System maintenance and change dimensions
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favoritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Diversity Formality Material Environment Goal Direction Disorganization Democracy
Individualized Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalization Participation	Independence Investigation	Differentiation
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher Support	Task Orientation Competition	Order and Organization Rule Clarity Teacher Control Innovation
College and University Classroom Environment Inventory (CUCEI)	Higher Education	7	Personalization Involvement Student Cohesiveness Satisfaction	Task Orientation	Innovation Individualization
My Class Inventory (MCI)	Elementary	6--9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
Science Laboratory Environment Inventory (SLEI)	Upper Secondary/ Higher Education	7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment
Questionnaire on Teacher Interaction (QTI)	Secondary/ Primary	8--10	Helping/Friendly Understanding Dissatisfied Admonishing		Leadership Student Responsibility Uncertain Strict
Constructivist Learning Environment Survey (CLES)	Secondary	7	Personal Relevance Uncertainty	Critical Voice Shared Control	Student Negotiation
What Is Happening In This Classroom (WIHIC)	Secondary	8	Student Cohesiveness Teacher Support Involvement	Investigation Task Orientation Cooperation	Equity

2.3 Researches Involving Learning Environment Instruments

Instruments mentioned above were used on many different samples, different cultures and different subjects by many researchers for many years. In this section some examples were given to the studies that include some of these instruments.

Recent learning environment researches have commonly focused on 1- determinants of the learning environment 2- differences between students' and teachers' perceptions of the same learning environment, 3- cross-national and cross-cultural studies, 4- investigating science laboratory learning environments, 5- perceptional differences between genders, 6- developing an instrument for evaluating a learning environment, 7- technology-rich learning environments, 8- teacher interpersonal behavior.

2.3.1 Determinants of the Learning Environment

Learning environment have been used as criterion variables in research aimed at identifying how the learning environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of the school (Fraser, 1994). Margianti, Fraser, and Aldridge (2001) conducted a study which reported the influence of the classroom learning environment on students' cognitive and affective outcomes among 2498 third-semester computer students in 50 university-level classes in Indonesia. Students' perceptions of the classroom environment were measured using an Indonesian version of The What Is Happening

In This Classroom? (WIHIC) questionnaire. To assess students' affective outcomes, a scale derived from the Test of Science Related Attitudes (TOSRA) was adapted for use in higher education computing classes and translated into Indonesian. Students' final scores in their mathematics course (either linear algebra or statistics) were used as a measure of cognitive achievement. Secondary aims of the present study were to examine whether differences exist between (a) students' perceptions of the actual and preferred classroom learning environment, (b) males' and females' perceptions of the actual classroom environment. According to the results for the simple and multiple correlation analysis, there were statistically significant associations between learning environment scales and student achievement at both the individual and class mean levels of analysis. For student attitudes, the results suggested that learning environment scales are positively and significantly correlated to student attitudes. The results suggested that lecturers wishing to improve student achievement should include lessons that allow for more student cohesiveness, teacher support, task orientation, equity, involvement and order and organization and lecturers wishing to improve students' attitudes should include lessons that allow for more of each dimension of the WIHIC. The results also indicate that male and female students have similar attitudes towards their lectures. There were statistically significant differences between students' perceptions of their actual learning environment and the one that they would prefer for all seven learning environment scales. The results indicated that students would prefer more of each WIHIC dimension than is currently perceived in their classes.

Another research that explored the nature of learning environments in Jammu, India was conducted by Koul and Fisher (2002). Multiple research methods from different paradigms were used in this study. A sample of 1021 students from 32 science classes in seven co-educational private schools completed the questionnaire on WIHIC and attitude scale. The multiple regressions showed that three scales namely investigation, task orientation and equity were positively and significantly related to student's attitudes. The quantitative data provided a starting point from which other qualitative methods (interviews and observations) were used to gain a more in-depth understanding of the classroom environments there. An educational critique has been used to describe the social, cultural, economical and political factors that may be responsible for the present prevailing learning environments. The findings from the quantitative data were supported by the findings of interviews and observations. From the student interviews, which were based on items of the WIHIC, the researcher felt that understanding of socio-cultural factors and educational system was important.

Researches conducted over the past 30 years have shown the quality of the learning environment in schools to be a significant determinant of student learning (Fraser, 1994, 1998, a). That is, students learn better when they perceive the learning environment positively. McRobbie and Fraser (1993) used the SLEI to investigation the associations between learning environments and student outcomes that was conducted specifically in science laboratory class settings. A sample of 1594 senior high school chemistry students responded to the SLEI. Student outcomes were gauged by two measures of inquiry skills and four attitude measures. The findings indicated that

students' perceptions of the classroom psychosocial environment accounted for appreciable amounts of variance in student outcomes even when student ability was controlled. Of the five scales of the SLEI, Integration showed the strongest positive association with both students' cognitive and attitudinal outcomes, whilst the few negative associations included those between rule clarity and students' inquiry skills.

Chionh and Fraser (1998) investigated the associations between actual learning environment and outcomes using actual and preferred forms of the What Is Happening in this Classroom? (WIHIC). The associations between examination results, self-esteem and attitude scale and seven learning environment scales were investigated in geography and mathematics classrooms in Singapore and Australia. It was found that better examination scores were achieved where students perceived the environment as more cohesive. Self-esteem and attitudes were more favorable in classrooms perceived as having more teacher support, task orientation and equity.

Another study on associations between learning environments in mathematics classrooms and students' attitudes, using the WIHIC questionnaire was studied by Rawnsley and Fisher (1998). They found that students develop more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, and where the teacher involved students in investigations.

Roth's (1998) study reported the results of a research project conducted as part of high school teachers' efforts to bring about reform of science education in their school. A sample of 43 students from two classes of grade 8, taught by the same teacher were monitored in terms of students' perceptions of their learning environment, achievement

levels, and conceptual understanding of research. Quantitative methods (questionnaire, tests and examinations, GPA) and qualitative methods (interviews, videotaped lessons, and artifacts) were combined while the learning environment was changed to a student-centered open inquiry format. Not unexpectedly, relationships between the autonomy and student-centeredness scales of the Constructivist Learning Environment Survey (CLES) and immediate (unit test) and delayed post-tests (examination subsection) were detected. On the other hand, although student-student interactions in small-groups and whole-class sessions were a significant part of the learning environment, the negotiation scale was not related to achievement.

Furthermore, most of the instruments translated into other languages. For example, The What Is Happening In This Classroom? (WIHIC) is originally in English. It was used in the studies in Singapore (Chionh & Fraser, 1998), Brunei (Riah & Fraser, 1998) and Korea (Kim, Fisher, & Fraser, 1999) to collect data pertaining to the classroom learning environment. The study in Singapore and Brunei validated an English version of the WIHIC questionnaire, whilst the study in Korea validated a Korean version of the questionnaire. The findings in each study replicated those of past research, reporting strong associations between the learning environment and student outcomes for almost all scales.

In certain cases, the questionnaires have been adapted without any modifications, while as in other cases modifications were made to suit the specific context. Hunus and Fraser (1997) used a modified version of the WIHIC in Brunei, and reported on the associations between perceptions of learning environment and attitudinal outcome.

Simple and multiple correlations showed that there was a significant relationship between the set of environment scales and students' attitudes towards chemistry theory classes. The student cohesiveness, teacher support, involvement, and task orientation scales were positively associated with the students' attitudes.

The most commonly used samples are the primary, secondary, and high school students for the learning environment studies. There are also studies that investigate other samples. For example Myint and Goh (2001) studied on the 355 graduate teacher trainers' perceptions of the learning environment in the teacher-training institution, in Singapore, using the College and University Classroom Environment Inventory (CUCEI) and also examined the associations between attitude and environment. The findings provided a significant attitude-environment relationship as well as gender-related differences among teacher trainees. It appears the learning environment in a tertiary institution was positively related with attitude in Singapore. These findings implied importantly that these graduate teacher trainees, having experienced positive learning environments in the teacher-training institute, would be more inclined to establish more positive learning environments in their classroom to enhance their students' learning.

2.3.2 Differences between Students' and Teachers' Perceptions of the Same Learning Environments

An investigation of differences between students and teachers in their perceptions of the same learning environment and of differences between the actual environment and that preferred by students or teachers were reported by Fisher and Fraser (1983). Students preferred a more positive learning environment than was actually present. Also, teachers perceived a more positive learning environment than did their students in the same classroom.

Rickards and Fisher (1998) conducted a study by a sample of 153 teachers and their 3515 students from 164 secondary school science classes in 35 schools completed the Questionnaire on Teacher Interaction (QTI). The result of this study showed that generally, teachers perceived their interactions more positively than did their students. The study also described how science teachers can and have used the questionnaire to assess perceptions of their own teacher-student interactions and used this as a basis for reflecting on their own teaching practice.

2.3.3 Cross-National and Cross-Cultural Studies

According to Phelan, Davidson, and Cao (1991), culture is the norms, values, beliefs, expectations, actions and emotional responses of the group. Science can be viewed as a cultural artifact. 'Science is embedded in, and influenced by, society and culture' (Aikenhead, 1997, p. 419). Some cultures see science as an acculturation

process that is opposed to their own society (Maddox, 1981, Hodson, 1993, Ogawa, 1995). Translation of instruments into another language provides opportunities to cross-cultural and cross-national studies. For example, Aldridge, Fraser, and Huang (1999) conducted a study to explore the nature of science learning environment in a cross-cultural study involving Australia and Taiwan. They used the English and Chinese versions of the What Is Happening In This Classroom? (WIHIC) questionnaire and Test of Science-Related Attitudes (TOSRA) to highlight cultural differences. Multiple research methods from different paradigms were used to explore classroom learning environments in Taiwan and Australia. A sample of 1081 grade 8 and 9 general science students from 50 classes in 25 schools in Western Australia and 1879 grade 8 and 9 general science students from 50 classes in 25 schools in Taiwan completed WIHIC and TOSRA. WIHIC was used to measure students' perceptions of their learning environment and TOSRA was used to assess students' satisfaction in terms of enjoyment, interest and how much they anticipated science classes. The data analysis showed that Australian students perceived their learning environments more favorable than did Taiwanese students. However, students in Taiwan had more positive attitudes toward science classes. Interviews based on items of the WIHIC were made with students. The researchers found that socio-cultural factors influence the learning environment.

Aldridge and Fraser (2000) conducted a similar research again but with different sample; junior high school science classes in Australia and Taiwan. Again same results were obtained from this study. This shows that cultural differences lead to perceptional

differences.

Another study was conducted by Aldridge, Fraser, and Taylor (2000) with another instrument. This cross-national study of science learning environments in Taiwan and Australia combined quantitative and qualitative methods. The quantitative data, collected using the Constructivist Learning Environment Survey (CLES), supported the reliability and validity of both an English and Mandarin version. The CLES was administered to 1081 students from 50 classes in Australia and 1879 students from 50 classes in Taiwan. Australian students perceived more critical voice and student negotiation and less personal relevance, uncertainty and shared control than students in Taiwan. Also, the attitudes of Taiwanese students towards their science classes were more positive than for students in Australia. A positive and statistically significant correlation was found between students' attitudes and each of the five scales of the CLES for both Taiwan and Australian data. They found that however, there were cultural factors which affected responses to these scales. For example, students in Taiwan appeared to have a higher regard for their teachers than did Australian students and were therefore less likely to criticize them. They also found that students in Taiwan were more likely to include instances outside the science class (such as discussions with peers for the student negotiation scale) which could have increased the mean score for this scale.

2.3.4 Investigating Science Laboratory Learning Environments

There are some studies investigating the laboratory environment, a setting in which the students work cooperatively in small groups to investigate scientific phenomena, a unique mode of instruction, and a unique mode of learning environment. Hofstein and Lunetta (1982) and Lazarowitz and Tamir (1994) suggest that laboratory activities have the potential to enhance constructive social relationships as well as positive attitudes and cognitive growth. Hofstein, Nahum, and Shore (2001) investigated the idea that generally the science laboratory provides a unique learning environment that differs from the learning environment that exists in classrooms in which other instructional techniques are used. In their study, Science Laboratory Environment Inventory (SLEI) was used to assess the students' perceptions of their chemistry laboratory learning environment. The sample consisted of two groups of students, the inquiry and the control groups. The inquiry group consisted of 130 eleventh grade students and the control group consisted of 185 eleventh grade students. The two groups comprised students who opted to study chemistry beyond the tenth grade (where chemistry is compulsory). Statistical comparison of two groups (control and inquiry) revealed significant differences between the groups regarding their actual perceptions. Moreover, it was found that the differences between the actual and preferred laboratory learning environment were significantly smaller for the inquiry group than for the control group.

Wong and Young (1997) investigated the relationships between students' attitudes towards chemistry and their perceived laboratory environments. The two instruments Chemistry Laboratory Environment Inventory (CLEI) and the Questionnaire on Chemistry-related Attitudes (QOCRA) were applied on a sample of 1592 final year secondary school students in 56 chemistry classes in 28 randomly selected co-educational government schools. CLEI, a modified version of the SLEI, was used to assess students' perceptions of the learning environment in chemistry laboratory classes and students' chemistry-related attitudes were assessed using QOCRA, which is based on the Test of Science-Related Attitudes (TOSRA). Positive associations emerged between the nature of the chemistry laboratory classroom environment and the students' attitudinal outcomes.

In a recent study, Wong and Fraser (2001) investigated the impact of the chemistry laboratory environment and teacher-student interaction on student attitudes towards chemistry for 200 gifted secondary-school students in Singapore. The data were obtained using three instruments: CLEI, QTI and QOCRA. Statistically significant associations were found between the nature of the laboratory classroom environment and students' attitudes towards chemistry. Associations were also found between the interpersonal behavior of the chemistry teachers and students' attitudes towards chemistry.

2.3.5 Perceptional Differences between Genders

Khoo and Fraser (1997) used a modified version of the What is Happening in This Class? (WIHIC) questionnaire to measure learning environments of adult computer courses. The cooperation scale was dropped in this modified version and student cohesiveness and teacher support were collapsed into one scale named trainer support. A set of 38 items was retained after factor analyses. This study indicated that the males perceived greater involvement, while females perceived more equity. The other striking result of the study was that older females had a more positive perception of trainer support than the younger ones.

Huang (2003) conducted a study to investigate factors such as school, subject, and several academic background variables that may be related to classroom learning environments of middle school students and whether the relationships vary by gender. Three shortened versions of student self-reported learning environment instruments were used, namely the Classroom Environment Scale (CES), the Instructional Learning Environment Questionnaire (ILEQ) (Knight & Waxman, 1989, 1990), and WIHIC questionnaire. The participants of this study were 644 seventh grade students from six middle schools in northern Taiwan. They represent four classes of students from each school. The results indicated that middle school students had favorable perceptions of their psychosocial environment. Most of them had high self-expectations but did not often investigate problems or do research to find solutions whenever they encountered difficulties or questions. They perceived high classroom rule clarity but had very low perceptions of their classroom order. Another result of this study was girls perceived

their classroom learning environments more positively than boys did. Girls were more involved, more affiliated and more cooperative with classmates than boys were. Gender is a key predictor of learning environment in this study. Despite coming from the same school, same classroom, and similar academic background, girls' academic background variables demonstrated greater effects on their perceptions of learning environment than their counterparts.

2.3.6 Developing or Validating an Instrument for Evaluating a Learning Environment

Fisher and Waldrip (1999) conducted a study to develop and validate an instrument to assess culturally sensitive factors of science students' learning environments, and to examine associations between these factors, students' achievement of enquiry skills, and students' attitudes to science and teacher-student interactions. A measure of culturally sensitive factors of the learning environment, namely the Cultural Learning Environment Questionnaire (CLEQ), was developed. The instrument, which was influenced by Hofstede's four dimensions of culture (power-distance, uncertainty--avoidance, individualism, and masculinity-femininity) and past learning environment research, contained seven scales. With a sample of over 3500 secondary science students, the reliability of the CLEQ scales ranged from 0.69 to 0.86 and showed acceptable discrimination between the scales as the mean correlation between scales ranged from 0.04 to 0.22. Regression analyses indicated that the most consistent predictors of teacher-student interpersonal behavior were the collaboration, deference,

competition, teacher authority and modeling scales. The most consistent predictors of students' attitudes and achievement were equity, competition, deference, modeling and congruence.

Chua and Wong (2001) made a research to validate an instrument, the Chinese Language Classroom Environment Inventory (CLCEI), for assessing students' perceptions toward their Chinese Language classroom learning environment in Singapore secondary schools. The CLCEI consists of six 8-item scales which were adapted from the WIHIC questionnaire (Fraser, McRobbie, & Fisher, 1996). The six scales are, 'student cohesiveness', 'teacher support', 'involvement', 'task orientation', 'cooperation' and 'equity' and were designed to measure six dimensions of a classroom learning environment. In addition, the CLCEI is a bilingual instrument with 48 items presented in both English and Chinese Language. The Chinese version was modified using the Taiwanese Chinese version for use in the Singapore context. The six scales of the CLCEI were validated with 1460 secondary students from 25 Singapore government secondary schools. The validation results showed that all the six scales of the CLCEI have high internal consistency reliability and adequate discriminant validity. Though the analysis on the discriminant validity showed that the six scales of the CLCEI assessed somewhat overlapping aspects of the Chinese Language classroom learning environments, the results were consistent with the validation results of the original WIHIC instrument.

Coll, Taylor, and Fisher (2002) reported the inquiry consisted of the application of two classroom learning environment questionnaires developed in a Western context to a culturally diverse context, namely, the Pacific Islands. The College and University Classroom Environment Inventory (CUCEI) and Questionnaire on Teacher Interaction (QTI) instruments were administered to intact classes of first- and second-year science students (n=5257) at a regional university in the Pacific Islands, containing a total of 12 ethnicities. The data reveal that the QTI instrument holds good reliability for all scales, whereas the CUCEI holds reliability for only two scales. This may be due to the simple nature of the questions on the QTI whereas the questions on the CUCEI require more interpretation, the latter exacerbated by the fact that English is a second or third language for most participants. Surprisingly, there were few differences in perceptions of teacher student interaction based on ethnicity, but substantial differences based on gender. The result of this study showed that females perceived their environment more favorably than males. The data for the QTI reveal that the students perceive their classrooms to be highly teacher dominated, consistent with previous naturalistic studies of secondary schools and exploratory studies at the tertiary level in Fiji.

2.3.7 Technology-Rich Learning Environment

Technological classrooms are providing a positive learning environment for students. To investigate this issue, Zandvliet and Straker (2001) reported an evaluation of the physical and psychosocial environments in computerized school settings through a combination of questionnaires and inventories that were later cross-referenced to case studies on a subset of these classrooms. Data were obtained from a series of physical evaluations of 43 settings in 24 school locations in British Columbia, Canada and Western Australia. Evaluations consisted of detailed inventories of the physical environment using the Computerized Classroom Environment Inventory (CCEI): an instrument developed specifically for this study. Data on psychosocial aspects of the environment were obtained with the WIHIC questionnaire administered to 1404 high school students making routine use of these computerized classrooms. Potential deficiencies in the physical environment of these locations included problems with individual workspaces, lighting and air quality, whereas deficiencies in the psychosocial environment were confined to the dimension of autonomy. Further analysis of these classroom environment data indicated that student autonomy and task orientation were independently associated with students' satisfaction with learning and that many physical (e.g. lighting and workspace dimensions) and psychosocial factors (e.g. students' perceptions of co-operation and collaboration) were also associated.

2.3.8 Teacher Interpersonal Behavior

Past review (e.g. Fraser, 1994) showed that science education researchers have led the world in the field of classroom environment research over the last three decades and that this field has contributed much to understand and improve science education. One particular development in this research occurred in The Netherlands where the focus was on the interactions that occurred between teachers and students. Wubbels, Creton, and Holvast (1988) investigated teacher behavior in classrooms from a systems perspective, adapting a theory on communication processes developed by Watzlawick, Beavin, and Jackson (1967). Within the systems perspective on communication, it is assumed that the behaviors of participants influence each other mutually. The behavior of the teacher is influenced by the behavior of the students and in turn the teacher's behavior influences student behavior. In consequence a circular communication process based upon interacting behaviors develops. In the development of the Questionnaire on Teacher Interaction (QTI), the Leary model was adapted. Timothy Leary, a clinical psychologist, described teacher characteristics with the communication model (Leary, 1957). Leary stated that communication can be described along two dimensions - a Dominance/Submission dimension, and a Cooperation/Opposition dimension (Figure 2.1).

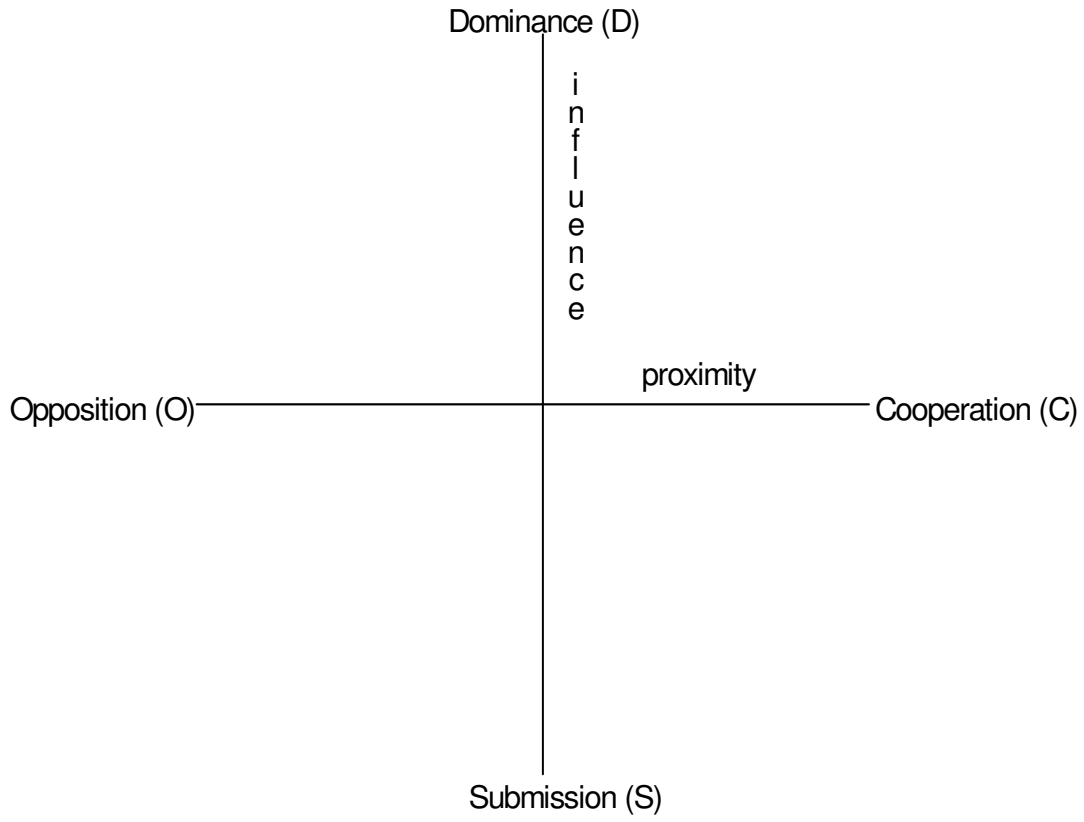

Figure 2.1 The Leary Model for Interpersonal Communication.

Wubbels and Levy (1993) built a paradigm which divided Leary's original two dimensions into the eight different scales shown in Figure 2.2, and demonstrates how the Leary model can be translated to the classroom: the Model for Interpersonal Teacher Behavior (MITB).

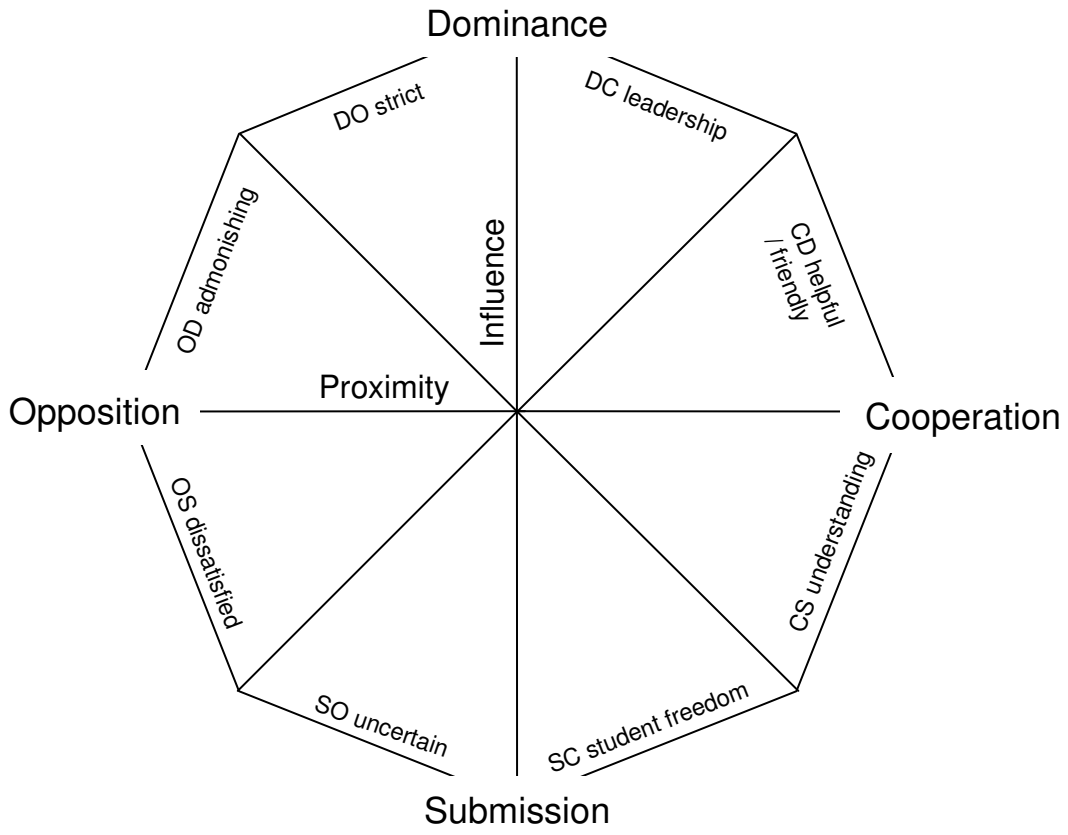

Figure 2.2 The Model for Interpersonal Teacher Behaviors

Teacher behavior is mapped using a proximity dimension [cooperation (C), opposition (O)] and an influence dimension [dominance (D), submission (S)]. Each of the items of the The Questionnaire on Teacher Interaction (QTI) is assigned to one of eight scales: leadership, helping/friendly, understanding, student responsibility/freedom, uncertain, dissatisfied, admonishing, and strict behavior. Variations in the students' attitudes toward the subject and the lessons have been characterized on the basis of the proximity dimension: the more cooperative the behavior displayed, the higher the

affective outcome scores (Wubbels, Brekelmans, & Hooymayers, 1991). That is, student responsibility and freedom, understanding, helping/friendly and leadership behaviors were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviors were related negatively to student attitudes. A similar pattern exists with cognitive achievement with the addition that strict or controlling behaviors are positively associated with cognitive outcomes. (Wubbels, Brekelmans, & Hooymayers, 1991). In the following section there were some examples for researches that investigate the variables that affect the interpersonal teacher behavior.

There are three forms of QTI; first one is students' perceptions of their actual teacher-student interpersonal behavior, second one is teacher's perceptions of their actual teacher-student interpersonal behavior in the classroom, and the last one is what they perceive to be ideal.

The study of Den Brok et al. (2003) investigated the reliability and the validity of the Questionnaire on Teacher Interaction (QTI) in 6 countries: United States, Australia, the Netherlands, Slovakia, Singapore and Brunei. QTI data were obtained from researchers that conducted their studies in each of the six countries, and were then re-analyzed to meet the purposes of the present study. To enhance comparison between countries, researchers were asked to provide only data on secondary Science (Physics and Chemistry) teachers. In all countries, convenience sampling was used, except for the Netherlands, where teachers were randomly sampled. Reliability of the scale scores at the class level was above .80 in most countries. In most countries, reliability was lowest for the student responsibility/freedom scale (SC) and strict scale (DO). On average,

reliability was highest for Australia and Singapore. Outcomes indicated that the scale inter-correlations corresponded with a circular ordering best for Australia and the Netherlands and least for Slovakia and Singapore. The study shows that results on the QTI cannot be compared between countries on the scale level and that further research is necessary to determine whether the instrument has cross-cultural validity.

The Questionnaire on Teacher Interaction (QTI) was mainly used for examining variables associated with differences in students' perceptions of interpersonal teacher behavior. For example, Levy, Den Brok, Wubbels, and Brekelmans (2003) conducted a study on 3023 students and 74 teachers in 168 classes in seven secondary schools. Investigating variance at the student, class, teacher and school levels revealed that several variables are significantly related to students' perceptions: student and teacher gender, student and teacher ethnic background, student age and grade, class size, grade level, subject taught and teacher experience. There were interaction effects between some variables, such as student ethnicity and student gender, as well as student and teacher gender. While significant, the amount of variance explained by these was low (around 10%).

Wubbles et al. (1991) investigated the relationships between perceptions on the QTI scales and student learning outcomes in The Netherlands. They found that regarding students' cognitive outcomes, the more that teacher demonstrated strict, leadership and helping/friendly behavior, the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviors were related negatively to achievement. This study also investigated the attitudes of students. Student

responsibility and freedom, understanding, helping/friendly, and leadership behaviors were related positively to student attitudes. Uncertain, dissatisfied, admonishing, and strict behaviors were related negatively to attitudes (effective outcomes).

According to Rawnsley and Fisher's (1998) study, in which QTI was applied to a sample of 490 year 9 students, students developed more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, place a strong emphasis on understanding the work, were involved in investigations, showed leadership, helping-friendly behavior and minimal admonishment of students. Students showed the greatest cognitive gains in classes where students perceived that the teacher emphasized understanding the work. The least cognitive gains occurred in classes where students perceived that the teacher was dissatisfied, gave them too much freedom and responsibility, and where they were involved in investigations.

Goh and Fraser (1998) investigated the two aspects of classroom learning environment (interpersonal teacher behavior and classroom climate) and their associations with affective and cognitive outcomes among primary mathematics students in Singapore. Also gender differences in students' achievement, attitudes and perceptions of classroom environment were explored. A random sample of 1512 boys and girls from government primary schools was completed the two questionnaires; the Questionnaire on Teacher Interaction (QTI) and the My Class Inventory (MCI). For the analysis of environment-outcome associations, simple, multiple and canonical correlation analyses and multilevel (hierarchical linear model) analyses were conducted using two units of analysis, namely, the individual student and the class mean. For the

analysis of gender differences, multivariate analyses of variance for repeated measures were performed for the two outcome measures and the classroom environment scales. Overall the different methods of analysis yielded consistent associations between classroom environment and student outcomes. Gender differences were detected in mathematics achievement, in favor of boys, but girls generally viewed their classroom environments more favorably than boys did.

The purpose of Henderson, Fisher and Fraser's (2000) study was to investigate associations between students' perceptions of their biology teachers interpersonal behavior and their laboratory learning environments and their attitudinal, achievement, and performance outcomes. A sample of 489 students from 28 senior biology classes in eight schools in Tasmania, Australia completed The Questionnaire on Teacher Interaction (QTI) and the Science Laboratory Environment Inventory (SLEI). Responses to two attitude questionnaires, achievement on an external written examination, and performance in laboratory practical tests were used as student outcome measures. According to this study, many aspects of interpersonal teacher behavior and the laboratory learning environment associated with students' attitudinal outcomes. For example, favorable student attitudes were found to be associated with a student's perceptions of the teacher's strong leadership, a greater degree of integration of practical and theory work, and more rule clarity. Furthermore, it was found that the teacher's strong leadership, provision of a degree of student responsibility and freedom, and integration of practical and theory components of the course were likely to promote achievement, whereas a greater degree of strict behavior by the teacher, emphasis on

rule clarity and an open-ended approach to the course are negatively associated with student achievement. In addition, results indicated that associations between attitudinal outcomes and learning environment dimensions assessed by the SLEI and QTI were stronger than with either achievement or practical outcomes. Nevertheless, students' perceptions of certain aspects of their learning environment (e.g., the integration of practical and theory work, the degree of open-endedness, the teacher's leadership behavior, and the level of student responsibility and freedom) were associated with cognitive and practical performance outcomes. This study also provides evidence of substantial differences between senior biology students' perceptions of their actual learning environment and the learning environment ideally liked or preferred. The results indicated that interpersonal teacher behavior, as measured by the QTI, and the laboratory learning environment, as measured by the SLEI, were complementary rather than overlapping aspects of the learning environment in terms of their associations with student outcomes.

A recent study conducted by Scott, Den Brok and Fisher (2004), explored the relationships between students' perceptions of their teachers interpersonal behavior and their subject-related attitude in primary science classes in Brunei. Teacher-student interpersonal behavior was mapped with the Questionnaire on Teacher Interaction (QTI) and reported in terms of two independent dimensions called Influence and Proximity. While prior research using QTI mainly focused on secondary education, the present study was one of the first in Brunei and in primary education and one of few studies to use multilevel analysis. Data from 1,305 students from 64 classes were used in this

study. Results indicated strong and positive effects of Influence and Proximity on students' enjoyment of their science class and supported findings of earlier work with the QTI. The result of this study replicated the previous study (Rickards & Den Brok, 2003).

Another recent study was conducted by Den Brok, Fisher, and Rickards (2004). They investigated whether student, teacher and class characteristics affect students' perceptions of their teacher interpersonal behavior. Using the Questionnaire on Teacher Interaction (QTI) in the U.S. and The Netherlands has shown that in those countries, several factors affect student's perceptions. These include student and teacher gender, student and teacher ethnic background, student age, teacher experience, class size, student achievement and subject. It has been found that each of these variables has a distinctive effect, but also that they interact with each other in determining students' perceptions. The results showed that the more positive the attitude of the student, the higher his or her perception of the teacher in terms of both influence and proximity. For gender, a negative relationship was found with both influence and proximity. This means that boys perceived their teachers as less dominant and cooperative than girls. Differences in perceptions were also reported with respect to ethnicity-related variables. Students speaking mainly English at home perceived their teachers as more dominant and more cooperative. As with gender and attitude, this finding supports earlier outcomes (Den Brok et al., 2003, Levy et al., 1997, 2003).

When teachers described their perceptions of their own behaviors, they tended to see it a little more favorably than did their students. On average, the teachers'

perceptions were between the students' perceptions of actual behavior and the teachers' ideal behavior. An interpretation of this is that teachers think that they behave closer to their ideal than their student think they do. Rickards and Fisher (2000, b) made a research to report teacher actual and ideal perceptions of the learning environment and to compare science students' perceptions with science teachers' perceptions. A sample of 3589 students in 173 science classes spread approximately equally between grades 8, 9, 10 in 35 different schools completed the student version of the Questionnaire on Teacher Interaction (QTI) while their 164 teachers completed the teacher self and teacher ideal versions. The result of this study showed that there were differences in teacher and student perceptions of teacher-student interpersonal behavior and that teachers tend to perceive their classes more positively than their students. Data also tended to suggest that teachers perceived their ideal teacher as being more positive than they currently are.

Rickards and Fisher (2000, a) conducted another study to compare science students' perceptions of their teacher-student interactions with those of their teachers. A sample of 3515 students from 164 secondary school science classes in 35 schools completed the QTI. The results showed that there were significant differences in the responses to six of the eight scales of the QTI, with teachers considering they exhibited greater leadership, helping/friendly and understanding behaviors than did their students. The differences generally indicated that teachers believed they were more cooperative and less oppositional in the classrooms than their students perceived. It showed that there were differences in teachers and students perceptions of teacher-student interpersonal behavior and that teachers tend to perceive their classes more positively than their

students.

Another study was conducted by Newby, Fisher, and Rickards (2001) to compare students' perceptions of teacher-student interactions with those of their teachers by administering The Questionnaire on Teacher Interaction (QTI) to teachers and students in 80 lower secondary classes in schools in Tasmania and Western Australia. The QTI was administered in 16 different schools and 80 science classes at the lower secondary in two Australian states, namely, Tasmania and Western Australia. The total sample involved 1,659 students spread approximately equally between grades 8, 9 and 10. Each student in the sample responded to the student version of the QTI while their 164 teachers completed the teacher self and teacher ideal versions. In the analysis, the students' perception of the teacher interaction was measured by using the class mean score as the unit of analysis. Two structural equation models were proposed in order to investigate possible relationships between a teacher's perception of their ideal and actual interaction, and relationships between a teacher's perception of the actual interaction and the class's perception of that interaction. The results would seem to confirm the underlying basis of the QTI in that the teachers' actual perceptions of their interactions with students affects the students' perceptions, which in turn affect the teachers' perceptions.

Another use of QTI was to provide a preliminary picture of teacher–student interaction. For example, Lee, Fraser, and Fisher (2003) conducted a study in Korean senior high schools. The aim of this study was to investigate three different aspects of the high school science classroom learning environments in Korea, namely, the degree

of implementation of constructivism, the pattern of teacher–student interactions, and the learning environment in laboratory classes. In order to do this, the QTI was administered to 439 students (99 science-independent stream students, 195 science-oriented stream students and 145 humanities stream students). Based on the results from this survey, interviews with some students and teachers were also carried out and three science classrooms were also observed. It was found that the teacher–student interactions in Korean senior high school science classrooms reflect the general image of the youth-elder relationship in society as well as the senior high school's unique nature – portraying a scene of 'directing teachers and obeying students'. It was also found that students experience unique interactions in their science classrooms with their particular teachers. It was considered that this difference comes from the overlapping of a teacher's personal characteristics with the nature of a stream (e.g., curriculum, expectation towards the students in that stream).

Goh and Fraser (1996) adapted the QTI for use in elementary schools in Singapore and investigated gender differences in students' perceptions of their teacher interpersonalbehavior. The results of this study indicated that in relation to boys, girls consistently rated their teacher interpersonalbehavior in a more positive way. For example, girls rated more highly their teachers' understanding and helping/friendly behavior and less highly their uncertain, dissatisfied, and admonishing behavior. Fisher, Fraser, and Rickards (1996, 1997) made a similar study with a sample of 3994 students from 182 secondary school science and mathematics classes in 35 schools to determine association between science and mathematics students' perceptions of their classroom

learning environments, the cultural backgrounds and gender of students. They argued that females perceive their teachers in a more positive way than do males, completed the QTI and an attitude test. Studies on gender differences and interpersonal teacher behavior was realized with different subjects, samples or in different countries. Similar results also obtained from Rawnsley and Fisher's (1997) study in Australia. While Riah, Fraser, and Rickards (1997) investigated students' perceptions of teacher interpersonalbehavior in the high school chemistry classes in Brunei Darussalam, Fisher, and Rickards (1998) studied with lower secondary science students in Tasmania and Western Australia. Both studies got the same results.

Levy, Wubbels, Brekelmans, and Morganfield (1997) investigated a sample of 550 high school students in 38 classes comprised of three primary investigation groups, namely 117 Latinos, 111 Asians and 322 from the United States. The primary focus was the language and cultural factors in students' perceptions of teacher communication style. This study focused on identifying ways in which the students' culture relates to student perceptions of their teachers. The results from this study suggested that the students' cultural background is indeed significantly related to the perceptions that they had of their teachers' interaction behavior. The study also concluded that teachers do not seem to be aware of cultural differences in their interactions with students in their classes in the same way as their students were, despite altering their behavior in classes with different cultural compositions.

To examine the cultural background of students and investigate differences in the way teachers interact with students of different cultural backgrounds, Evans and Fisher (2000) investigated a sample of 2986 science students in 153 classes in 48 Australian secondary schools in two Australian states, Victoria and Western Australia. The sample covered science classes at lower secondary levels spread approximately equally between grades 8, 9 and 10. The study used the classroom environment measuring instrument, the QTI. The study found that statistically significant differences exist between students from different cultural backgrounds and their perceptions of student-teacher interactions. In a recent study, Den Brok, Veldman, Wubbels, and Tartwijk (2004) investigated students' and teachers' perceptions of teacher interpersonalbehavior in Dutch multicultural classes, the relationships between students' ethnic and socio-cultural background and their perception of the learning environment, and teachers' cognitions regarding interpersonal behavior in multicultural classrooms. QTI was applied to a sample of 365 students from 18 classes of 15 Dutch secondary education teachers. Results showed that culturally related differences in students' perceptions and teachers using a variety of strategies and knowledge in teaching multicultural classes. Results on teacher knowledge about teaching strategies for multicultural classrooms confirmed indications in the literature on general effective teaching competencies as well as previously found effective teaching methods in multicultural classes.

Wubbels (1993) applied the QTI to a sample of 792 students and 46 teachers in Western Australia and Tasmania. The results of this study were similar to previous Dutch and American research in that teachers generally, did not reach their ideal and

differed from the best teachers as perceived by students. It is noteworthy that the best teachers, according to students, are stronger leaders, more friendly and understanding, and less uncertain, dissatisfied and admonishing than teachers on average. When teachers described their perceptions of their own behaviors, they tended to see it a little more favorably than did their students. On average, the teachers' perceptions were between the students' perceptions of actual behavior and the teachers' ideal behavior. An interpretation of this is that teachers think that they behave closer to their ideal than their student think that they do.

While researches exist concerning student-teacher interactions and education generally, apparently no research has examined whether these interactions are related to exemplary (effective) teaching. Because it has been established that students' perceptions of their classroom environment and teacher-student interactions affect student achievement (Fraser, 1998, Wubbel s & Levy, 1993), it is important to examine whether The Questionnaire on Teacher Interaction (QTI) can be used to identify and describe better (exemplary) teachers. The purpose of the Waldrip and Fisher's (2003) study was to determine the usefulness of the QTI to identify and describe exemplary science teachers. Exemplary teachers were identified through very favorable scores on the QTI. 493 science students and their 25 teachers in 25 Australian secondary school classrooms were responded to the QTI. A number of students from classes that had indicated very positive student-teacher interactions were interviewed to examine why these students had such positive perceptions. The interviews showed that the better teachers were identified as those whose students' perceptions were more than one

standard deviation above the mean on the scales of leadership, helping/friendly, and understanding and more than one standard deviation below the mean on the uncertainty, dissatisfied and admonishing scales. It is apparent from these interviews that these better teachers tried to interest students in the learning process, involve students in developing understanding, were friendly, gave students responsibility and had a level of strictness that students were comfortable and such that they felt was conducive to learning. Overall, this study has shown that identifying the better (exemplary) teachers using students' perceptions of their interpersonal behavior is worthwhile.

2.4 Summary of the Literature Review

- Classroom learning environment refers to a space or a place where learners and teachers interact with each other and use a variety of tools and information resources in their pursuit of learning activities (Wilson, 1996). The nature of the classroom environment and psycho-social interactions can make a difference in how the students learn and achieve their goals (McRobbie, Roth & Lucus, 1997).
- Researches showed that learning environment has positive effects on affective and cognitive outcomes (Margianti, Fraser & Aldridge, 2001, Koul & Fisher, 2002, Chionh & Fraser, 1998, Roth, 1998, Hunus & Fraser, 1997, Myint & Goh, 2001).

- Researches also indicated the effects of the differences of students' perceptions on learning environment that their perceptional differences were due to many factors such as student gender, teacher gender, cultural background, students age, etc.. According to Khoo and Fraser (1997), and Huang (2003), females, older students etc. rated their learning environment in a more positive way.
- The critical component of the classroom atmosphere is heavily influenced by the interpersonal skill of a teacher (Creton, Wubbels, & Hooymayers, 1989). Studies showed that students perceptions of interpersonal teacher behavior was affected by student and teacher gender, student and teacher ethnic background, student age, teacher experience, class size, student achievement and subject (Goh & Fraser, 1996, Fisher, Fraser & Rickards, 1997, Fisher & Rickards, 1997 Fisher & Rickards, 1998, Levy, Wubbels, Brekelmans & Morganfield, 1997, Evans & Fisher, 2000, Den Brok, Fisher, & Rickards, 2004, Den Brok & Fisher, 2004).
- Interpersonal teacher behavior has a positive affects on students' affective and cognitive outcomes (Wubbels et al.,1991, God & Fraser, 1998, Henderson, Fisher & Fraser, 2000, Scott, Den Brok & Fisher, 2004).

CHAPTER III

METHOD

In the previous chapters, problems and hypotheses of the study were presented, related literature was reviewed accordingly and the significance of the study was justified. In the following chapter, population and sampling, description of the variables, instruments of the study, procedure and methods used to analyze data and assumptions and limitations will be explained briefly.

3.1 Population and Sample

All eighth grade state schools' students in Turkey were identified as the target population of this study. However, it is appropriate to define an accessible population since it is not easy to come into contact with this target population. The accessible population was determined as all eighth grade students in Yenimahalle districts of Ankara. This is the population which the results of the study will be generalized.

The population being sampled in this study was 8713 eighth grade students according to the Provincial Directorate of National Education in Ankara. Accordingly the desired sample size was determined as 871 students, which is approximately 10% of the whole population. But the study was able to applied to only 722 students, which is

8.3 % of the whole population. Fourty-nine percent of them were girls. Table 3.1 presents number of elementary school in the selected district and number of students from this district.

Table 3.1 Numbers of elementary schools, selected elementary schools, and number of Selected Students among the Yenimahalle District.

Number of Elementary Schools	Number of Selected Elementary Schools	Number of Selected Classes	Number of Selected Students
85	5	24	722

3.2 Variables

There are 6 variables involved in this study, which were categorized as dependent and independent.

3.2.1 Dependent Variable

The dependent variables (DV) were students' perception of interpersonal teacher behavior and learning environment. These variables are continuous.

3.2.2 Independent Variable

The independent variables (IV) were students' attitude towards science, students' science achievement, students' and teachers' gender. Among these, gender is discrete and nominal scale of measurement. Attitude towards science and science achievement are discrete and in ordinal scale of measurement.

3.3 Data Collection Instruments

In this study, three instruments were used in order to obtain data from students. These are the Turkish version of the What is Happening in This Classroom? (T-WIHIC) questionnaire, the Turkish version of the Questionnaire on Teacher Interaction (T-QTI), and Science Attitude scale. The WIHIC was used to assess and describe the students' perceptions on science learning environment. The QTI was used to assess and describe the students' perceptions on science interpersonal teacher behavior. Science attitude test was used to assess the students' attitudes toward science.

3.3.1 What Is Happening In This Class (WIHIC) Questionnaire

The WIHIC was developed by Fraser, McRobbie, and Fisher (1996) to bring parsimony to the field of learning environments by combining the most salient scales from existing questionnaires with new dimensions of contemporary relevance to assess seven dimensions of the classroom environment. The WIHIC consists of 7 scales (each

includes 8 items) and 56 items.. All items are scored 1, 2, 3, 4 and 5, respectively, for the responses of Almost Never, Seldom, Some-times, Often and Almost Always.

Table 3.2 Scale description for each scale and example of items in the What Is Happening In This Class? (WIHIC) Questionnaire. (Koul & Fisher, 2002).

Scale	Description	Item	Moos' Scheme
Student Cohesiveness [ST]	Extent to which students know, help and are supportive of one another.	I know the other students in this class (+)	R
Teacher Support [TS]	Extent to which teacher helps, befriends, trusts, and shows interest in students.	The teacher takes a personal interest in me. (+)	R
Involvement [IV]	Extents to which students have attentive interest, participate in discussions, perform additional work and enjoy the class.	I explain my ideas to other students. (+)	R
Investigation [IN]	Extent to which there is emphasis on the skills and their use in problem solving investigation.	I carry out investigations to test my ideas. (+)	P
Task Orientation [TO]	Extent to which it is important to complete activities planned and to stay on the subject matter.	I pay attention in this class. (+)	P
Cooperation [CP]	Extent to which students cooperate rather than compete with one another on learning tasks.	I work with other students. (+)	P
Equity [EQ]	Extent to which the teacher treats students equally.	I'm treated the same as other students in this class. (+)	S

Table 3.2 gives the descriptive information for the seven scales of the WIHIC. R refers to the Relationship, P refers to the Personal Development, S refers to the System Maintenance and System Change based on Moos's Scheme.

The questionnaire was translated and adapted into Turkish by Çakıroğlu, Telli and Çakıroğlu (2003). They reported that a factor analysis and item analysis suggest the factorial structure of the WIHIC developed by Fraser et al. (1996) was the same as that which was observed for the Turkish sample.

For the present study, because of economical reasons and the length of the whole inventory, it is shortened to 41 items (see Appendix B). The item-scale distribution of T-WIHIC is shown in Table 3.3

Table 3.3 Item-scale distribution of the T-WIHIC for the present study

T-WIHIC Scales	Inventory Items	Items per Scale
Student Cohesiveness ST	1, 2, 3, 4, 5, 6	6
Teacher Support TS	7, 8, 9, 10, 11, 12	6
Involvement IV	13, 14, 15, 16, 17	5
Investigation IN	18, 19, 20, 21, 22, 23	6
Task Orientation TO	24, 25, 26, 27, 28, 29	6
Cooperation CP	30, 31, 32, 33, 34, 35	6
Equity EQ	36, 37, 38, 39, 40, 41	6

One of the characteristics of a learning environment scale is that students within a class see their learning environment relatively similarly, and that average class perceptions vary from class to class. For that reason, for the reliability analysis Cronbach's alpha coefficient was conducted using both the individual scores and class means as the unit of analysis. As expected, reliability estimates were higher in most instances when the class mean was employed as the unit of analysis. A one way analysis of variance (ANOVA) was conducted to determine if the Turkish version of the modified WIHIC was able to differentiate between the perceptions of students in different classrooms. This characteristic was examined for each scale with class membership as the main effect and using individual scores as the unit of analysis (Table 3.4).

As shown in Table 3.4, the Cronbach alpha coefficient ranged from 0.78 to 0.88 when individual scores were used as the unit of analysis. Alpha coefficient for seven scales ranged from 0.87 to 0.95 when class means were used as the unit of analysis. The results of a series of analysis of variance (ANOVA) showed that each scale in this questionnaire was able to differentiate significantly ($p<0.001$) between the perceptions of students in different classes. The eta squared statistics (which is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for class by membership), ranging from 0.07 (investigation) to 0.14 (teacher support) for the different T-WIHIC scales (Table 3.4) indicating that the instrument was able to distinguish between classes. Only teacher support showed large affect, others showed medium effect. The results of the analyses suggests that each scale

of the T-WIHIC was able to differentiate significantly ($p<0.01$) between students' perceptions in different classes.

Table 3.4 Internal consistency reliability (Cronbach Alpha Coefficient) and ability to differentiate between classrooms (ANOVA results) for the T-WIHIC scales for the two unit of analysis.

T-WIHIC Scales	Unit of Analysis	Alpha Reliability	ANOVA Results (eta squared
ST	Individual	0.79	0.08
	Class Mean	0.87	
TS	Individual	0.88	0.14
	Class Mean	0.95	
IV	Individual	0.83	0.08
	Class Mean	0.91	
IN	Individual	0.86	0.07
	Class Mean	0.93	
TO	Individual	0.79	0.09
	Class Mean	0.91	
CP	Individual	0.78	0.13
	Class Mean	0.92	
EQ	Individual	0.86	0.10
	Class Mean	0.93	

3.3.2 The Questionnaire on Teacher Interaction (QTI)

Because teachers communicate in many ways, they naturally develop different types of relationships with students. Some teachers are businesslike and others lenient. Some are distant and others friendly. To describe these characteristics more clearly, the communication model of Timothy Leary (Leary, 1957), a clinical psychologist, was adopted. Leary stated that communication can be described along two dimensions-a Dominance/Submission, and a Cooperation/Opposition dimensions (Figure 3.1).

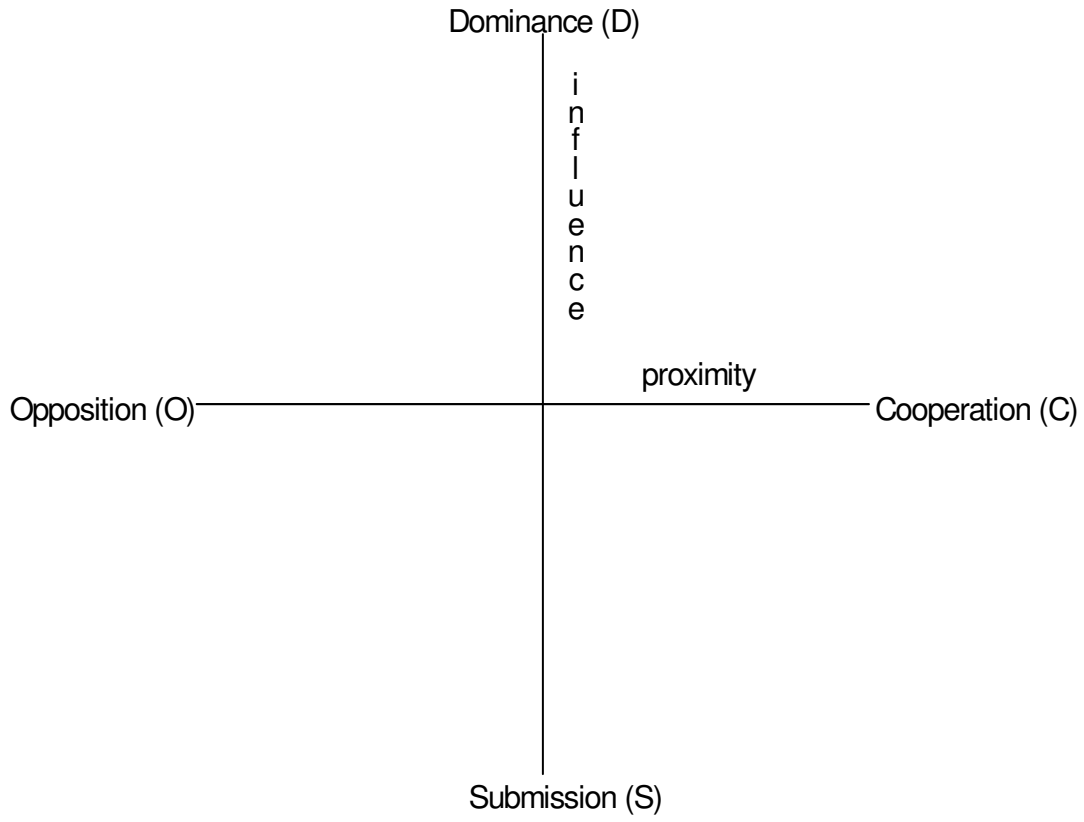

Figure 3.1 The Leary Model for Interpersonal Communication.

The critical component of the classroom atmosphere is heavily influenced by the interpersonal skill of a teacher (Creton, Wubbels, & Hooymayers, 1989). With this in mind, Wubbels, Creton, and Hooymayers (1985) developed their Model for Interpersonal Teacher Behavior (MITB), to map interpersonal teacher behavior extrapolated from the work of Leary (1957).

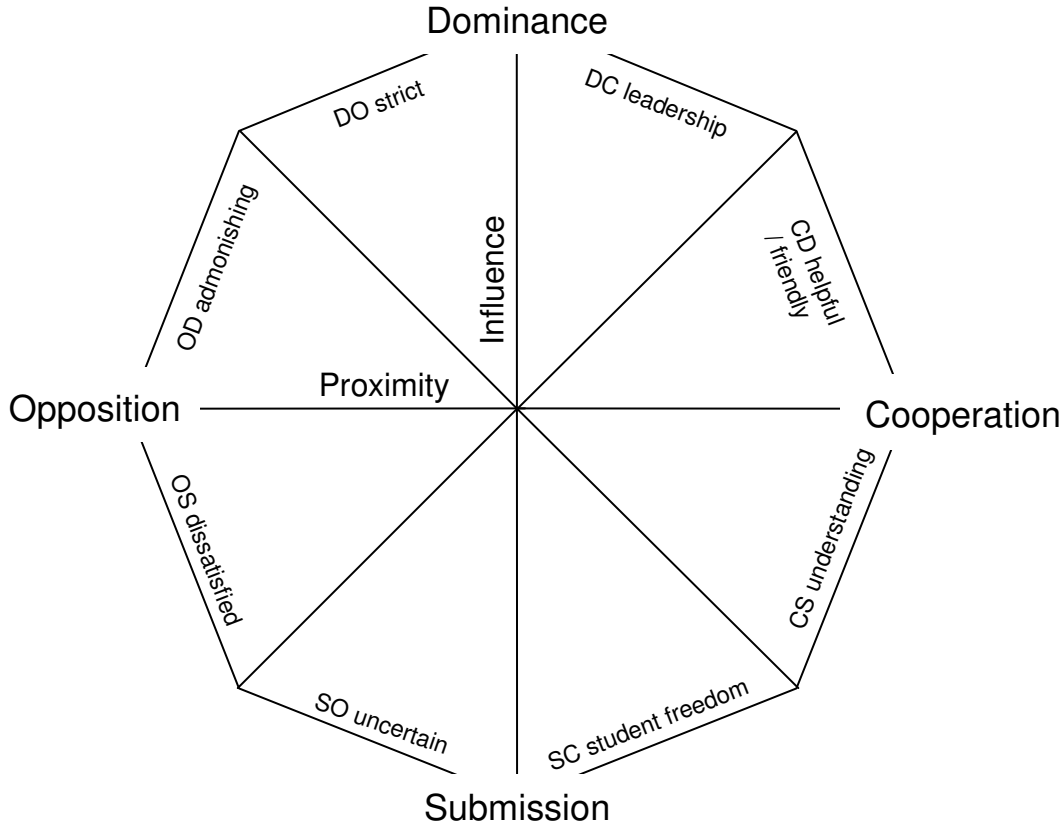

Figure 3.2 The Model for Interpersonal Teacher Behaviors

Wubbels and Levy (1993) built a paradigm which divided Leary's original two dimensions into the eight different scales shown in Figure 3.2, which demonstrates how the Leary model can be translated to the classroom: the Model for Interpersonal Teacher Behavior (MITB).

This model (Figure 3.2) maps teacher behavior with the aid of two dimensions: an influence dimension (describing who is in control in the teacher-student relationship, the teacher or the student) and a proximity dimension (describing the degree of cooperation between teacher and students). The influence dimension is characterized by teacher dominance (D) on one end of the spectrum, and teacher submission (S) on the other end. Similarly, the proximity dimension is characterized by teacher cooperation (C) on one end, and by teacher opposition (O) on the other. The two dimensions can be depicted in a two-dimensional plane that can be further subdivided into eight categories or scales of behavior: leadership (DC), helping/friendly behavior (CD), understanding behavior (CS), giving responsibility/freedom (SC), uncertain behavior (SO), dissatisfied behavior (OS), admonishing behavior (OD) and strictness (DO). Each scale can be described in terms of the two dimensions: leadership, for example, contains a high degree of influence and some degree of cooperation; helping/friendly behavior some degree of dominance and a high degree of cooperation; etc.

Table 3.5 Description of scales and sample items for each scale of the QTI. (Rickards, Newby, & Fisher, 2001).

Scale name	**Description of scale (The extent to which the teacher...)**	**Sample item**
Leadership- DC	...leads, organizes, gives orders, determines procedure and structures the classroom situation.	This teacher talks enthusiastically about his/ her subject.
Helping/friendly -CD	...shows interest, behaves in a friendly or considerate manner and inspires confidence and trust.	This teacher helps us with our work.
Understanding- CS	...listens with interest, empathizes, shows confidence and understanding and is open with students.	This teacher trusts us.
Student responsibility/ freedom-SC	...gives opportunity for independent work, gives freedom and responsibility to students.	We can decide some things in this teacher's class.
Uncertain-SO	...behaves in an uncertain manner and keeps a low profile.	This teacher seems uncertain.
Dissatisfied-OS	...expresses dissatisfaction, looks unhappy, criticizes and waits for silence.	This teacher thinks that we cheat.
Admonishing-OD	...gets angry, express irritation and anger, forbids and punishes.	This teacher gets angry unexpectedly.
Strict-DO	...checks, maintains silence and strictly enforces the rules.	This teacher is strict.

The Questionnaire on Teacher Interaction (QTI) developed in the Netherlands in 1984 to gather data on teacher communication style (Wubbels & Levy, 1991, Wubbels et al., 1985). It can be used to map students' (and teachers') perceptions of interpersonal teacher behavior according to the MITB. The QTI originally consisted of 77 items, answered on a Likert-type 5-point scale (1= never to 5= always). The items of the QTI

refer to the eight scales of behavior – leadership, helping/friendly, understanding, giving responsibility/freedom, uncertain, dissatisfied, admonishing and strict – that jointly make up the MITB. Table 3.5 clarifies further the nature of the QTI by providing a scale description and a sample item for each of the eight scales.

Since its development, the QTI has been the focus of well over 120 (learning environment) studies in many countries (Den Brok, Brekelmans, Levy, & Wubbels, 2002) and has been translated into more than 15 languages (Wubbels, Brekelmans, Van Tartwijk, & Admiraal, 1997). The original QTI, designed for secondary education, also formed the basis for a number of other versions for primary education, higher education, principals and supervisors (Den Brok, 2001). A more economical 48-items selection has been developed in Australia (Wubbels, 1993, see also Fisher, Henderson & Fraser, 1995).

In the present study, firstly the QTI was translated to Turkish by the researcher. Independent back translation of the Turkish version into English was realized by two qualified, bilingual Turkish graduate students who were not involved in the original translation. Then the Turkish researchers checked the back translations and, for some items, necessary modifications in the Turkish translation were carried out. Some items were consulted to English teachers and instructor from the Department of Foreign Language Education. Content and format of the instrument were checked by an expert from the Science Education Department, two science teachers, a graduate student from Science Education department, and English teachers. The suggestions of these people were taken into consideration; the necessary changes were done accordingly.

Pilot study was conducted in the 2003 fall semester with 201 seventh grade students from 7 classes and 31 eighth grade students from 1 class in two secondary schools. For the QTI, somewhat different statistical procedures from those used for other instruments were performed. Both factor analysis and discriminant validity analysis are irrelevant for the QTI, because of its conceptual idiosyncratic structure, which is based on Leary's (1957) circumplex model of interpersonal behavior. Instead, the pattern of inter-scale correlation was calculated as another measure of the circumplex model of the QTI, as recommended by Wubbels and Levy (1993).

The inter-scale correlation of T-QTI is shown in Table 3.6 and Figure 3.3. It indicated that the pattern of correlations between the helping/friendly scale and the other seven scales using the individual as unit of analysis. That is helping/friendly scale shows the highest correlation with the adjacent scales understanding (r=.793) and leadership (r=.716) and shows the highest negative correlation with the opposite scale dissatisfied (r=-.554).

Table 3.6 Inter-scale correlations of the T-QTI scales.

	DC	CD	CS	SC	SO	OS	OD	DO
DC	1	.716**	.668**	.549**	-.408**	-.479**	-.282**	-.106**
CD		1	.793**	.559**	-.344**	-.554**	-.433**	-.297**
CS			1	.551**	-.327**	-.616**	-.546**	-.315**
SC				1	-.139**	-.364**	-.253**	-.172**
SO					1	.454**	.294**	.072
OS						1	.684**	.501**
OD							1	.491**
DO								1

** Correlation is significant at the 0.01 level (2-tailed) (p< 0.01)

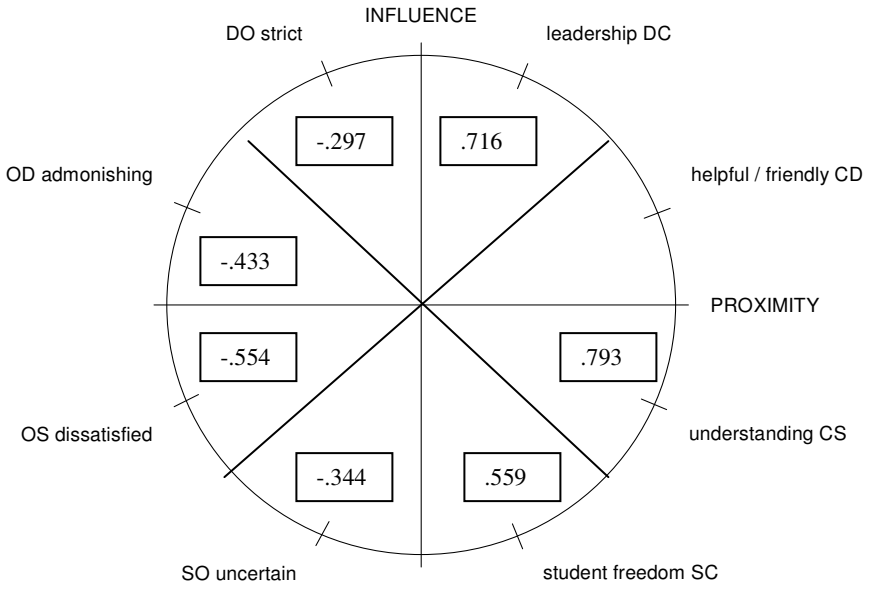

Figure 3.3 Profile of inter-scale correlation for helping/friendly scale.

In addition to validating the T-QTI using the pattern of scale inter-correlations discussed in the previous sections, the Turkish version of the QTI was validated in terms of internal consistency (Cronbach alpha reliability) and ability to differentiate between classrooms (ANOVA). In line with previous researches, statistics are reported for two units of analysis; namely, the student's score and the class mean score. Table 3.7 suggests that the T-QTI has quite good reliability, with five out of eight scales (namely, leadership, helping/friendly, understanding, dissatisfied and strict) having values above 0.88 for class mean, and the same five scales having values between 0.70 and 0.82 with the individual student as the level of analysis. As expected, reliability for class means are higher than those where the individual student is used as the unit of analysis. This meant that scales were unidimensional at the class level. These values for a Turkish sample are comparable to those reported by Wubbels (1993), and Wubbels and Levy (1991) for secondary students in The Netherlands, the USA and Austalia. In all four countries, the highest reliability occurred for helping/friendly teacher behavior and the lowest for students responsibility/freedom. A series of analyses of variance (ANOVA), with class membership as the main effect revealed significant differences ($p<0.01$) for every QTI scale between the perception of students in different classes. The eta squared statistics (which is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for class by membership), ranging from 0.11 to 0.34 for different the T-QTI scales (Table 3.9) indicating that the instrument was able to distinguish between classes. Only SO scale show the small effect with the eta squared value of 0.11. Others show large effect. The results of the analyses suggests that

each scale of the T-QTI was able to differentiate significantly ($p<0.01$) between students' perceptions in different classes.

Table 3.7 Internal consistency reliability (Cronbach Alpha Coefficient) and ability to differentiate between classrooms (ANOVA results) for the T-QTI.

T-QTI Scales	Unit of Analysis	Alpha Reliability	ANOVA Results (eta squared)
DC leadership	Individual	0.77	0.24
	Class Mean	0.92	
CD helping/friendly	Individual	0.82	0.25
	Class Mean	0.94	
CS understanding	Individual	0.81	0.25
	Class Mean	0.95	
SC student	Individual	0.59	0.18
responsibility/freedom	Class Mean	0.71	
SO uncertain	Individual	0.59	0.11
	Class Mean	0.71	
OS dissatisfied	Individual	0.79	0.25
	Class Mean	0.91	
OD admonishing	Individual	0.65	0.31
	Class Mean	0.84	
DO strict	Individual	0.70	0.34
	Class Mean	0.88	

Based on the pilot study results, necessary modifications were done. According to the reliability analysis and economical factors some items were deleted, the instruments shortened to 47 items. So the final form of the T-QTI for the present study was obtained (see Appendix A). The item-scale distribution of the T-QTI for this study is shown in Table 3.8.

Table 3.8 Item-scale distribution of the T-QTI for the present study.

T-QTI Scales		Inventory Items	Items Per scale
LEADERSHIP	(DC)	4, 8, 12, 16, 20, 23	6
HELPING/FRIENDLY	(CD)	25, 29, 33, 37, 41, 45	6
UNDERSTANDING	(CS)	27, 31, 35, 39, 43, 47	6
STUDENT RESPONSIBILITY/ FREEDOM	(SC)	3, 7, 11, 15, 19, 22	6
UNCERTAIN	(SO)	2, 6, 10, 14, 18	5
DISSATISFIED	(OS)	26, 30, 34, 38, 42, 46	6
ADMONISHING	(OD)	28, 32, 36, 40, 44	5
STRICT	(DD)	1, 5, 9, 13, 17, 21, 24	7

3.3.3 Science Attitude Scale

This scale developed by Geban et al. (1994) to measure student's attitudes toward sceince as a school subject. This scale consists of 15 items in 5-point likert scale (Strogly agree, agree, undecided, disagree, strongly disagree). In the present study, the reliability of Science Attitude scale is 0.91, where each item has a mean higher than 3 and standart deviation ranged between 1.2 and 1.4.

3.4 Procedure

After completing the literature review, the participant schools and subjects of the study were determined and permission was granted for the study from the Ministry of Education. After that the researcher administered all of the measuring instruments (T-

WIHIC, T-QTI, and science attitude test) to the selected 722, 8th grade students from 24 classes in 5 schools during the second term of the 2003-2004 semester. One class hour was given to the participants to complete all the instruments. Directions were made clear and necessary explanations were done by the researcher. Students were also assured that any data collected from them would be held in confidence. They were warned to complete all measuring tools without leaving any empty items as well.

Due to the time restriction and impossibility of being present in each class during administration, the researcher occasionally request teacher support. The teachers were informed about the study and about the directions that should be done prior to the administration. No specific problems were encounter during the administration of the measuring instruments.

3.5 Analysis of Data

The data obtained in the study were analyzed by using both descriptive statistics and inferential statistics.

3.5.1 Descriptive Statistics

The mean, and the standard deviation, skewness, kurtosis and histograms of the variables were presented.

3.5.2 Inferential Statistics

ANOVA and MANOVA results were presented. A one way analysis of variance (ANOVA) was conducted to determine if the Turkish versions of the modified WIHIC and QTI were able to differentiate between the perceptions of students in different classrooms. One-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate the differences between boys and girls perceptions on two aspects of classroom environment (learning environment and teacher interpersonal behavior)and to investigate the differences between students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of their science classroom environment.

Simple correlation and multiple regressions analyses were conducted to examine whether associations exists between the students' perceptions of both learning environment and interpersonal teacher behavior with the students' affective and cognitive outcomes. Simple correlation analysis was used to provide information about the bivariate relationship between the students' cognitive and affective outcomes and each individual environment and interpersonal teacher behavior scales. Multiple regression analysis was used to describe the joint relationship between the students' cognitive and affective outcomes and the whole set of seven learning environment scales and eight teacher interpersonal scales. Using the standarized regression coefficients (β), both the learning environment scales and interpersonal teacher behavior scales which contributed uniquely and significantly to the explanation of the variance in the dependent variable were identified.

3.6 Assumptions and Limitations

The assumptions and the limitations of this study considered by the researcher are given below.

3.6.1 Assumptions

- all the students in the study responded the items of the T-QTI, T-WIHIC and attitude tests sincerely and correctly.
- the administrator of the instruments was under standard conditions.
- the students of the pilot study were assumed to have approximately the same characteristics as the actual subjects of the study.

3.6.2 Limitations

- although the instruments shortened, three of them might be too long for students.
- the study consists of only the Yenimahalle District to investigate.
- only the 8th grade students were the sample of the study.
- samples selected in a convenience manner.

CHAPTER IV

RESULTS

The results of the study are explained in five different sections. The first section presents missing data. The second section is descriptive statistics in which dependent variables of the study are explored. The third section deals with the inferential statistics. The last section is for summarize the results.

4.1 Missing Data

The first step is related with missing data analysis. It was carried out before descriptive and inferential statistics. The questionnaires were applied to 722 students. Girls are the % 49 of the whole population. Four of these students were completely excluded from the study, since their all scores were missing.

4.2 Descriptive Statisitcs

Descriptive statistics related to students' each of the T-WIHIC and T-QTI sub-scale scores, namely student cohesiveness (ST), teacher support (TS), involvement (IV), investigation (IN), task orientation (TO), cooperation (CP), and equity (EQ) for the

T-WIHIC questionnaire; leadership (DC), helping/friendly (CD), understanding (CS), student responsibility/freedom (SC), uncertain (SO), dissatisfied (OS), admonishing (OD), and strict (DO) for the T-QTI are presented in Table 4.1 and Table 4.2.

4.2.1 Descriptive Statistics for Learning Environment

The average item mean (the scale mean divided by the number of items in that scale) and average item standard deviation of each scale of the T-WIHIC for the two unit of analysis were calculated to explore the nature of the science classroom learning environment. One of the characteristics of a classroom environment scale was that students within a class see their classroom environment similarly, and that avarage class perceptions vary from class to class. Thus both individual and class mean values were displayed in Table 4.1. The high mean scores shown in Table 4.1 suggested a positive classroom environment, with the mean scores ranging between 0.58 and 0.80 when the maximum value is equal to 1; which corresponds to ‘often’ and the minimum value is equal to 0; which corresponds to ‘never’. The students perceived task orientation and cooperation more positively. The scores for these scales were 0.80 for task orientation, 0.76 for cooperation. The students perceived involvement and investigation scales approximately 0.60. The standard deviations for all scales were less than 1, suggesting that there is not large diversity in the students' perceptions. Generally, the students perceived a very positive science classroom learning environment in Turkey.

When we look at the skewness and kurtosis values, all seven scales of the T-WIHIC lie between -1 and +1 accepted as excellent for most psychometric purposes.

Table 4.1 Average item mean and average item standard deviation for the T-WIHIC scales for two unit of analysis

T-WIHIC Scales	Unit of Analysis	No of items	Average item mean	Average Item Std. Deviation	Skewness	Kurtosis
ST student cohesiveness	Individual	6	0.70	0.21	-.761	.186
	Class Mean		0.70	0.06		
TS teacher support	Individual	6	0.70	0.29	-.252	.188
	Class Mean		0.70	0.11		
IV involvement	Individual	5	0.59	0.26	-.203	.188
	Class Mean		0.58	0.07		
IN investigation	Individual	6	0.60	0.24	-.114	.189
	Class Mean		0.59	0.07		
TO task orientation	Individual	6	0.80	0.19	-.988	.188
	Class Mean		0.80	0.06		
CP cooperation	Individual	6	0.76	0.26	-.224	.190
	Class Mean		0.76	0.10		
EQ equity	Individual	6	0.67	0.26	-.635	.189
	Class Mean		0.68	0.09		

Note: When the values replaced with the values maximum:1 and minimum:0

Figure 4.1 demonstrate the average item mean of the T-WIHIC scales for the two unit of analysis. As shown in the figure, students viewed that task orientation is the highest, and the cooperation is the second highest properties of their science learning

environment. The lowest properties that they viewed in their learning environment are the involvement and investigation.

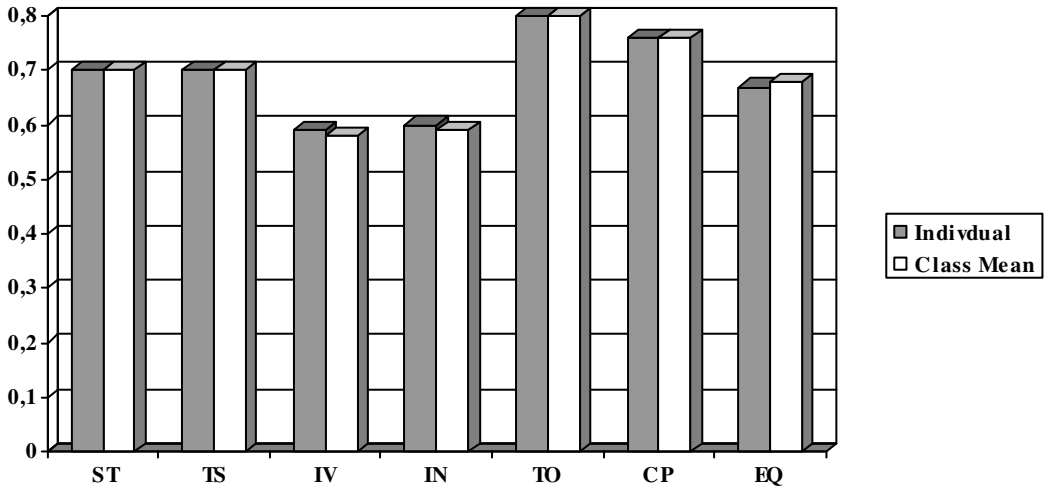

Figure 4.1 Average item mean for the T-WIHIC scales for the two unit of analysis.

Figure 4.2 presents the histograms with normal curve related to the seven scales of T-WIHIC. Although some of the histograms were left-skewed, they can be accepted as evidences for the normal distribution of the dependent variables.

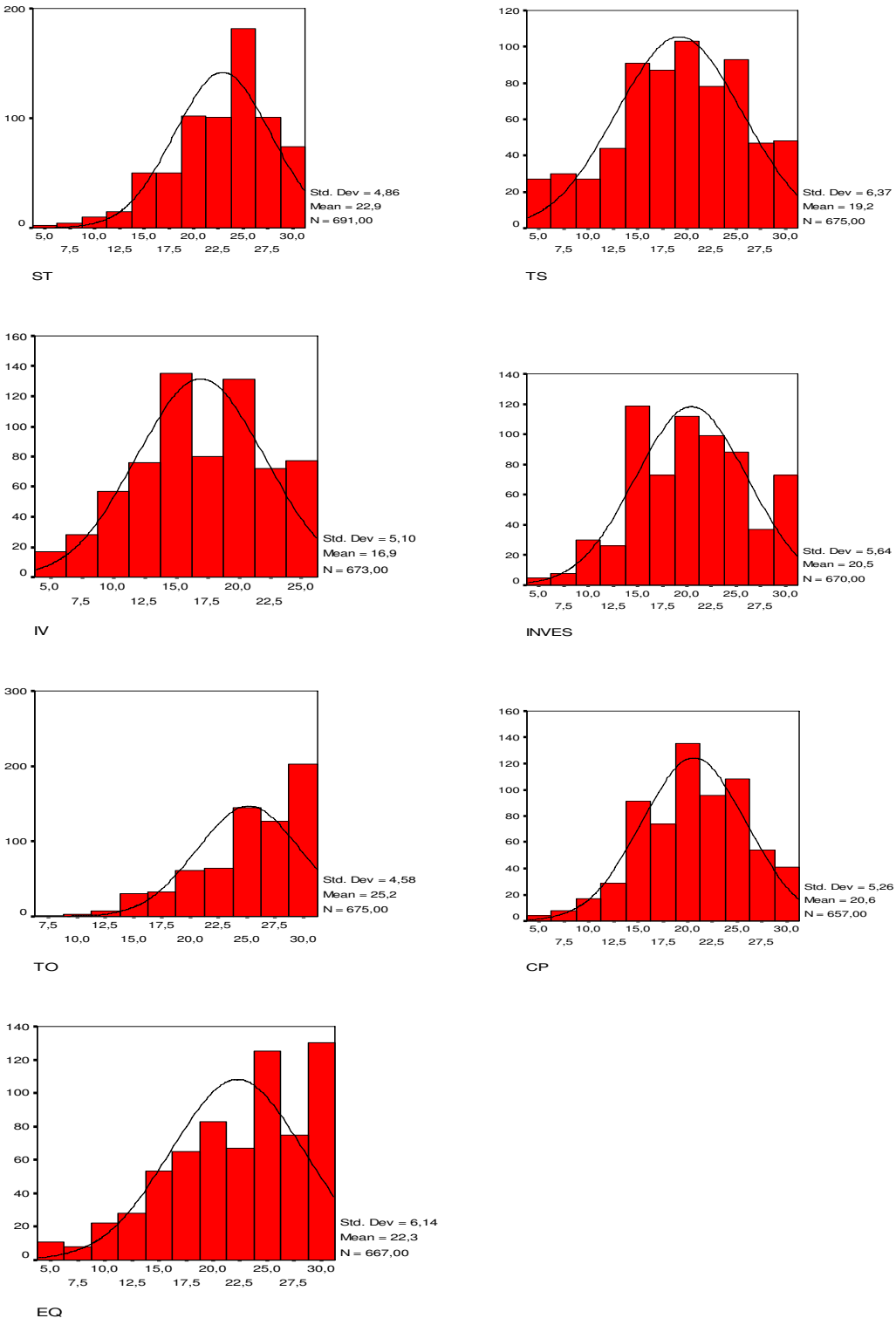

Figure 4.2 Histograms with normal curves for the seven scales of the T-WIHIC.

4.2.2 Descriptive Statistics for Interpersonal Teacher Behavior

To explore the nature of the science teacher interpersonal behavior in Turkey, the average item mean (the scale mean divided by the number of items in that scale) and average item standard deviation of each scale of the QTI were calculated. Students perceived that their teachers display cooperative behaviors (leadership, helping/friendly, and understanding) rather than opposition behaviors (uncertain, dissatisfied, admonishing, strict) in terms of interaction with them as described in Table 4.2. The mean score for the leadership and understanding scales (approximately 0.7 when the maximum value is equal to 1; which corresponds to 'often') implied that students perceived relatively strong leadership and understanding behavior from their teachers during their lessons. For the helping/friendly scale, the average item mean score was fairly higher than 0.5 which corresponds to sometimes, implying that teachers in the Turkish secondary schools are normally helping/friendly. On the other hand, the strict scale have the mean of 0.46; lower than 0.5. The mean scores for the student responsibility/freedom and admonishing scales (corresponding to 'seldom') reflects the tendency of Turkish secondary school teachers not to allow their students much freedom or responsibility in their lessons. It also reminds us of the fact that Turkish secondary school teachers normally use lecturing rather than any other teaching strategies. The dissatisfied and uncertainty scales showed relatively low average item means (0.24 and 0.16 when the min value is 0; which correspond to 'never') indicating that these two behaviors are displayed at least in science lessons in Turkey.

Figure 4.3 presents the average item Mean for the T-QTI scales for the two unit of analysis. The results showed that Turkish secondary school science teachers run their classes with fairly strong leadership, accompanied by a somewhat helping, friendly and understanding behavior, and with fairly weak strict behavior, but that they do not display uncertain and admonishing behaviors.

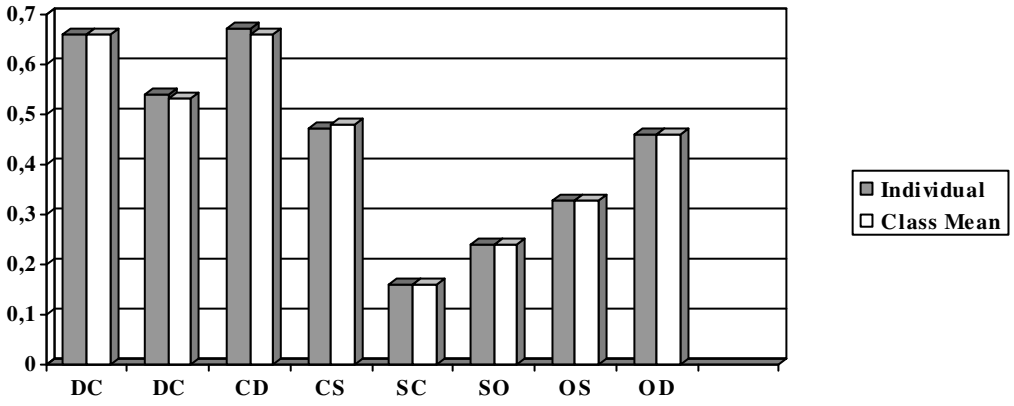

Figure 4.3 Average item mean for the T-QTI scales for the two unit of analysis.

Figure 4.4 presents the histograms with normal curve related to the eight scales of T-QTI. Although some of the histograms were right-skewed, they can be accepted as evidences for the normal distribution of the dependent variables. When we look at the skewness and kurtosis values, six of the eight scales lie between the -1 and +1 values. Only, CD and CS scales are higher than 1 in absolute valeu, but they are in approximately acceptable range for a normal distribution.

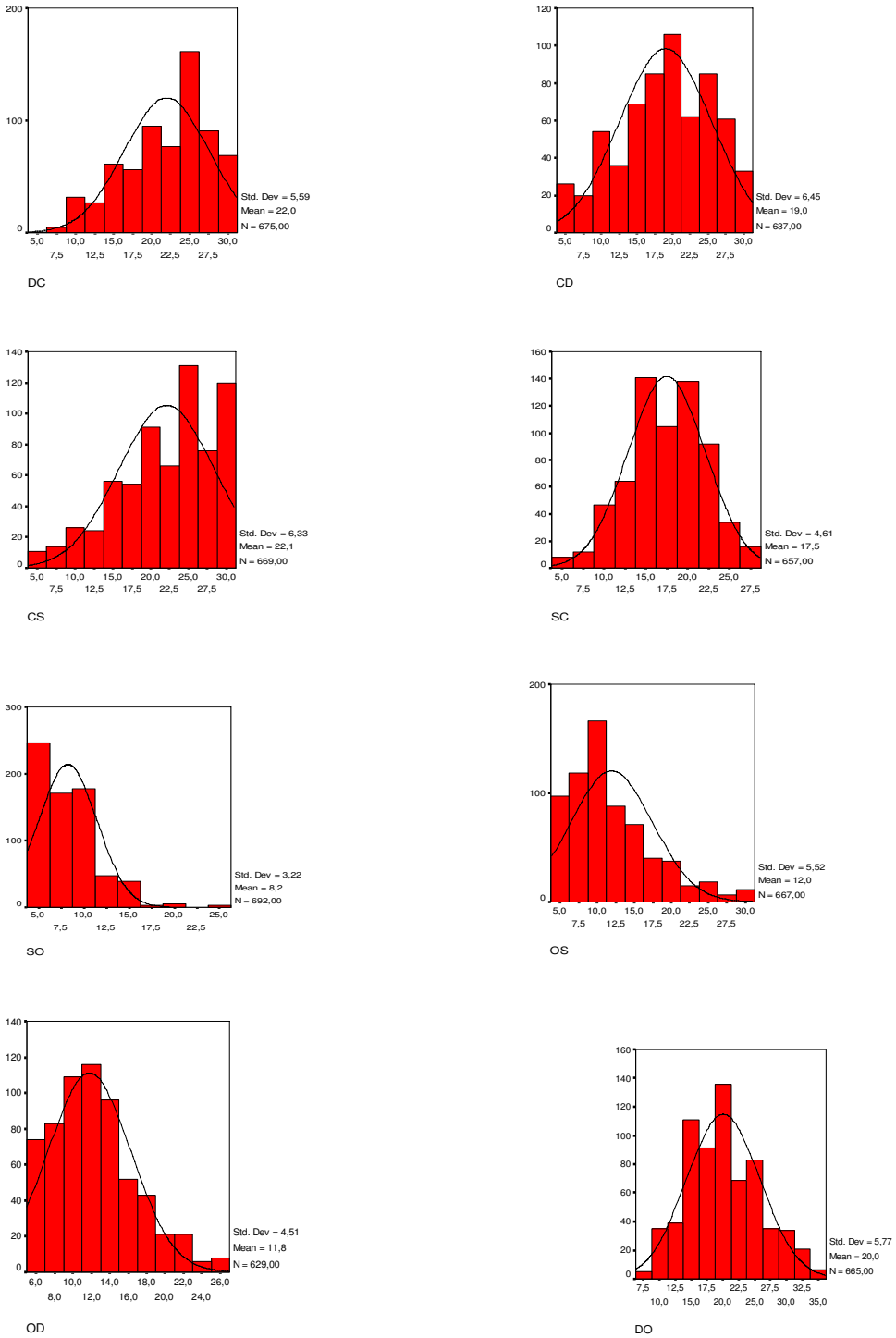

Figure 4.4 Histograms with normal curves for the QTI scales

Table 4.2 Average item mean and average item standard deviation for the T-QTI scales for two unit of analysis

T-QTI Scales	Unit of Analysis	No of items	Average item mean	Average Item Std. Deviation	Skewness	Kurtosis
DC leadership	Individual	6	0.66	0.23	-.358	.189
	Class Mean		0.66	0.11		
CD helping/ friendly	Individual	6	0.54	0.11	1.117	.186
	Class Mean		0.53	0.13		
CS understanding	Individual	6	0.67	0.26	-.366	.190
	Class Mean		0.66	0.13		
SC student responsibility /freedom	Individual	6	0.47	0.19	-.499	.188
	Class Mean		0.48	0.09		
SO uncertain	Individual	5	0.16	0.16	-.764	.193
	Class Mean		0.16	0.05		
OS dissatisfied	Individual	6	0.24	0.23	1.132	.189
	Class Mean		0.24	0.12		
OD admonishing	Individual	5	0.33	0.22	-.369	.189
	Class Mean		0.33	0.12		
DO strict	Individual	7	0.46	0.20	.078	.195
	Class Mean		0.47	0.24		

Note: When the values replaced with the values maximum:1 and minimum:0

4.3 Inferential Statistics

This section deals with the verification of one-way between-groups multivariate analysis of variance (MANOVA) assumptions, analysis of variances (ANOVA), bivariate correlations and multiple regression analyses of the hypotheses.

4.3.1 Assumptions of Mutlivariate Analysis of Variance

MANOVA has the assumptions of multivariate normality, equity of covarianc matrices, equity of variances and independences of observations assumptions. Since four seperate MANOVAs were conducted with two groups of dependent variables (learning environment scales and interpersonal teacher behavior scales) across two grpous of independent variables (students' gender and teachers' gender), the assumptions were tested for four different grpous of data.

Since there is no statistical analysis available for multivariate normality, univariate normality were checked for each of the dependent variables by using skewness and kurtosis values given in section 4.2. The skewness and kurtosis value of the dependent variables were inacceptable range for a normal distribution.

For the equality of covariance matrices assumption, Box's test of equality of covariance matrices was conducted (Table 4.3 and 4.4). As seen from the Table 4.3, the observed covariance matrices of the dependent variables are not equal across groups for either of the data. As seen from the Table 4.4, the observed covariance matrices of the dependent variables are equal across groups for either of the data.

Table 4.3 Box's test of equality of covariance matrices for hypotheses 3 and 7

	QTI	**WIHIC**
Box's M	72.942	76.384
F	1.989	2.689
df1	36	28
df2	688729	920731
Sig.	.000	.000

Table 4.4 Box's test of equality of covariance matrices for hypotheses 4 and 8

	QTI	WIHIC
Box's M	62.736	40.959
F	1.722	1.443
df1	36	28
df2	1498052	995661
Sig.	.005	.061

For the equality of variances assumption, Levene's Test of Equality was used. As indicated in Table 4.5, all scales of the T-WIHIC, except TO, and three scales of the T-QTI (CD, SC and DO) across students' gender were equal. All scales of the T-WIHIC and five scales of the T-QTI (SC, SO, OS, OD, and DO) across teachers' gender were equal.

The last assumption states that observations should be independent of one another. The administration of the inventory did not involve interactions among subjects; therefore they did not influence each other. It was observed that all participants did their test by themselves.

The normality and independence of observations assumptions are the assumptions of bivariate correlation also. These two assumptions were verified as discussed above for MANOVA.

Table 4.5 Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
Students' perceptions on learning environment across students' gender				
ST	.395	1	515	.530
TS	.018	1	515	.894
IV	.932	1	515	.335
IN	.208	1	515	.649
TO	46.508	1	515	.000
CP	.026	1	515	.873
EQ	3.468	1	515	.063
Students' perceptions on interpersonal teacher behavior across students' gender				
DO	2.610	1	455	.107
SO	5.407	1	455	.020
SC	.068	1	455	.794
DC	3.967	1	455	.047
CD	2.836	1	455	.093
OS	30.798	1	455	.000
CS	6.693	1	455	.010
OD	4.141	1	455	.042
Students' perceptions on learning environment across teachers' gender				
ST	.525	1	567	.469
TS	3.616	1	567	.058
IV	.073	1	567	.787
IN	.048	1	567	.828
TO	.256	1	567	.613
CP	1.642	1	567	.201
EQ	1.328	1	567	.250
Students' perceptions on interpersonal teacher behavior across teachers' gender				
DO	1.732	1	716	.189
SO	.089	1	716	.765
SC	.004	1	716	.948
DC	7.585	1	716	.006
CD	8.034	1	716	.005
OS	2.964	1	716	.086
CS	10.767	1	716	.001
OD	.251	1	716	.616

4.3.2 Null Hypothesis 1

There is no significant relationship between the 8th grade students' attitutes towards science and their perceptions of science learning environment.

Simple correlation and multiple regressions analyses were conducted to examine whether associations exists between students' perceptions of learning environment and the students' affective outcome (Table 4.6). As it is shown in the table, there is a correlation between attitude towards science and learning environment scales; small correlation between ST and CP and medium correlation among the other five scales when using a simple correlation analysis. The multiple regression, R, was 0.54 and is statistically significant ($p<0.01$). This strongly supports that the nature of the classroom environment is strongly influencing students' attitudes towards science lessons. In order to interpret this relationship, the standardised regression coefficient (β) was also examined. It was found that out of seven scales, four scales retained their significance ($p<0.01$). This means that the scales teacher support, investigation, task orientation and equity are independent predictors of individual students' attitude towards science lessons. The R2 value, which indicates the proportion of variance in attitude towards science lessons that can be attributed to students' perception of classroom environments was 30 % ($F= 36.138$; $p<0.005$).

Favorable student attitudes were found to be associated with a students' perceptions of the learning environment in classes where students perceive that they get the high amount of teacher support, that they frequently use investigative methods, that they are on task, and that the class operates equitably, students show a more positive

attitude towards their science.

Table 4.6 Associations between the T-WIHIC scales and students' affective outcomes in terms of simple correlation (r) and standardised regression coefficient (β)

T-WIHIC SCALES	B	B	t	P	r
CONSTANT	24.955		9.227		
ST	- 0.200	-0.079	-1.936	0.053	0.157**
TS	0.429	0.222	4.760	0.000**	0.409**
IV	- 0.123	-0.05	-1.059	0.290	0.308**
IN	0.534	0.243	5.176	0.000**	0.444**
TO	0.559	0.203	4.404	0.000**	0.426**
CP	- 0.184	-0.077	-1.847	0.065	0.194**
EQ	0.266	0.131	2.625	0.009**	0.406**
Multiple Correlation, R	0.54				
Variance, R^2	0.30				

** Correlation is significant at the 0.01 level (2-tailed).

4.3.3 Null Hypothesis 2

There is no significant relationship between the 8th grade students' science achievement and their perceptions of science learning environment

Simple correlation analysis was conducted to examine whether associations exist between students' perceptions of science learning environment and the students' cognitive outcomes. Science achievement scores were the students' previous semester science grades notes over 5. Approximately half of the students (47 %) didn't write their grades. The analysis were conducted over the students who wrote their grades (N =

380). Table 4.7 indicated that there was positive small correlation with science achievement and the ST, IN, and CP scales and medium correlation with TS, IV, TO and EQ scales of the T-WIHIC.

The multiple regression, R, was 0.47 and is statistically significant ($p<0.01$). This strongly supports that the nature of the learning environment is strongly influencing students' science achievement. In order to interpret this relationship, the standardised regression coefficient (β) was also examined. It was found that out of seven scales, five scales retained their significance ($p<0.01$). This means that the scales students cohesiveness, teacher support, involvement, task orientation and equity are independent predictors of individual students' science achievement. The R2 value, which indicates the proportion of variance in science achievement that can be attributed to students' perception of learning environment was 22% ($F= 13.711$, $p<0.005$).

Table 4.7 Associations between the T-WIHIC scales and students' cognitive outcomes in terms of simple correlation (r) and standardised regression coefficient (β).

T-WIHIC SCALES	B	β	t	P	r
CONSTANT	0.692		1.525	0.128	
ST	-0.042	-0.135	-2.387	0.018**	0.104**
TS	0.032	0.136	2.126	0.034**	0.343**
IV	0.059	0.202	3.069	0.002**	0.360**
IN	0.001	0.005	0.079	0.937	0.286**
TO	0.056	0.170	2.628	0.009**	0.333**
CO	-0.021	-0.072	-1.244	0.214	0.156**
EQ	0.043	0.174	2.530	0.012**	0.379**
Multiple Correlation, R	0.47				
Variance, R^2	0.22				

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

4.3.4 Null Hypothesis 3

There is no significant difference between the 8th grade boys and girls with respect to their perceptions of science learning environment.

To test whether there is a difference exist between boys and girls perceptions of science learning environment, MANOVA were conducted. The results were demonstrated in the Table 4.8. According to the MANOVA results, there was significant difference between boys and girls on the combined dependent variables (the T-WIHIC scales): F(7, 509) = 5.724, p= .000; Wilk's Lambda = .927; partial eta squared= .0073. when the results of the variables considered seperately, each scales reach statistical

differences. As expected, girls rated their learning environment in a more positive way than do boys.

Table 4.8 MANOVA results for null hypothesis 3

T-WIHIC Scales	GENDER	Mean	Std. Error	F	Sig.	Eta squared
ST	Boys	23.798	.300	6.105	.014	.012
	Girls	22.761	.294			
TS	Boys	20.708	.382	9.073	.003	.017
	Girls	19.098	.374			
IV	Boys	17.846	.312	5.553	.019	.011
	Girls	16.818	.305			
IN	Boys	21.518	.345	6.438	.011	.012
	Girls	20.292	.338			
TO	Boys	26.621	.271	36.081	.000	.065
	Boys	24.345	.265			
CP	Girls	21.581	.315	11.165	.001	.021
	Boys	20.110	.308			
QE	Girls	23.830	.363	11.421	.001	.022
	Male	22.114	.355			

4.3.5 Null Hypothesis 4

There is no significant difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of science learning environment.

A one-way between groups multivariate analysis of variance (MANOVA) were used to test whether there is a difference between the 8th grade students' thought by a male teacher and those thought by female teachers with respect to students' perceptions of science learning environment (Table 4.9). There was a significant differences between males and females on the combined dependent variables (the T-WIHIC scales) [F(7, 561) = 2.11, p = 0.041; Wilk's Lambda = 0.97 partial eta squared = 0.026]. When the results of the dependent variables were considered seperately, the only difference to reach statistical significance using Bonferoni adjusted alpha level of 0.009 was cooperation [F (1, 567) = 5.964, p= 0.015, partial eta squared = 0.01], An inspection of the mean scores indicate that students perceived their learning environment of male teachers' classes slightly higher levels (M=0.78, SD=0.016) of cooperation than females (M=0.73, SD= 0.014).

Table 4.9 MANOVA results for null hypothesis 4.

T-WIHIC Scales	TEACHER GENDER	Mean	Std. Error	F	Sig.	Eta squared
ST	Female	0.71	0.21	0.40	0.53	0.001
	Male	0.72	0.20			
TS	Female	0.70	0.30	1.29	0.26	0.002
	Male	0.73	0.28			
IV	Female	0.58	0.26	3.73	0.05	0.007
	Male	0.61	0.26			
IN	Female	0.60	0.24	0.03	0.86	0.000
	Male	0.60	0.25			
TO	Female	0.80	0.20	0.04	0.85	0.000
	Male	0.80	0.19			
CP	Female	0.73	0.27	5.96	0.02	0.100
	Male	0.78	0.24			
QE	Female	0.69	0.26	0.09	0.76	0.000
	Male	0.68	0.25			

Cooperation scale showed significant differences between students' perceptions on learning environment of their female and male teachers' classes; male teachers' classes were rated more cooparetive than female teachers' class.

4.3.6 Null Hypothesis 5

There is no significant relationship between the 8th grade students' attitudes toward science and the students' perceptions of their science teacher interpersonal behavior.

Simple correlation and multiple regressions analyses were conducted to examine whether associations exist between students' perceptions of teacher interpersonal behavior and the students' attitudes towards their science classes (Table 4.10). As indicated in the Table 4.7, there was a positive medium correlation between the DC, CD, CS, and SC scales. On the other hand, there was a negative small correlation between the attitude and SO, OS, OD, and DO scales. The correlation between DO and attitude was small, and correlations between attitude and other scales were medium.

The multiple correlation, R, was 0.44 and is statistically significant ($p<0.01$). This strongly supports that the nature of the interpersonal teacher behaviors is strongly influencing students' attitudes towards science lessons. In order to interpret this relationship, the standardised regression coefficient (β) was also examined. It was found that out of seven scales, three scales retained their significance ($p<0.01$). This means that the scales leadership, students responsibility/freedom and admonishing behavior are independent predictors of individual students' attitude towards science lessons. The R2 value, which indicates the proportion of variance in attitude towards science lessons that can be attributed to students' perception of interpersonal behavior was 20% ($F= 16.745$, $p<0.005$).

Favorable student attitudes were found to be associated with a students' perceptions of the teacher interpersonal behavior when students perceive that their teacher display more leadership, helping/friendly, understanding behavior and when they get high amount of resposibility/freedom, students show a more positive attitude towards their science.

Table 4.10 Associations between the T-QTI scales and students' affectice outcomes in terms of simple correlation (r) and standardised regression coefficient (β).

T-QTI SCALES	B	β	t	P	r
CONSTANT	42.346		10.396	0.000	
DC	0.561	0.249	4.057	0.000**	0.374**
CD	-0.090	-0.047	-0.661	0.509	0.320**
CS	0.041	0.021	0.276	0.782	0.341**
SC	0.477	0.175	3.586	0.000**	0.322**
SO	-0.316	-0.081	-1.798	0.073	-0.215**
OS	0.147	0.064	1.004	0.316	-0.274**
OD	-0.375	-0.134	-2.380	0.018**	-0.258**
DO	-0.171	-0.078	-1.671	0.099	-0.169**
Multiple Correlation, R	0.44				
Variance, R^2	0.191				

** Correlation is significant at the 0.01 level (2-tailed). **p < 0.01

4.3.7 Null Hypothesis 6

There is no significant relationship between the 8th grade students' science achievement and the students' perceptions of their science teacher interpersonal behavior.

Simple correlation and multiple regression analyses were conducted to test this hypothesis. Table 4.11 indicated that there was a small correlation with science achievement and all the T-QTI scale. DC, CD, ST, and CS scales had positive correlation, while SO, OS, OD, and DO scales had negative correlation with achievement (N=380). All the scales were significant at the $p<0.01$, except DC which is significant at the $p<0.05$.

The multiple correlation, R, was 0.30 and is statistically significant ($p<0.01$). This supports that the nature of the interpersonal teacher behaviors is influencing students' science achievement. In order to interpret this relationship, the standardised regression coefficient (β) was also examined. It was found that out of seven scales, two scales retained their significance ($p<0.01$). This means that the scales students responsibility/freedom and the dissatisified behaviors are independent predictors of individual students' science achievement. The R2 value, which indicates the proportion of variance in science achievement that can be attributed to students' perception of interpersonal behavior was 10% ($F= 4.633$, $p<0.005$).

Table 4.11 Associations between the T-QTI scales and students' cognitive outcomes in terms of simple correlation (r) and standardized regression coefficient (β).

T-QTI SCALES	B	β	t	P	r
CONSTANT	4.532		7.048	0.000	
DC	-0.019	-0.068	-0.859	0.391	0.119*
CD	0.026	0.108	1.210	0.227	0.170**
CS	-0.044	-0.181	-1.952	0.052	0.133**
SC	0.058	0.176	2.775	0.006**	0.191**
SO	-0.052	-0.111	-1.909	0.057	-0.166**
OS	-0.047	-0.171	-2.068	0.039**	-0.235**
OD	-0.010	-0.029	-0.408	0.684	-0.177**
DO	-0.013	-0.049	-0.799	0.425	-0.153**
Multiple Correlation, R	0.30				
Variance, R^2	0.09				

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

4.3.8 Null Hypothesis 7

There is no significant difference between the 8th grade boys and girls with respect to their perceptions of their science teacher interpersonal behavior.

The differences between boys and girls perceptions on interpersonal teacher behavior were tested by using MANOVA. As indicated in Table 4.12, there was a significant differences between boys and girls on the dependent vriables (the T-QTI scales): F(8, 448) = 3.902, p=.000; Wilk's Lambda = .935; partial eta squared = .065. When the results of the dependent variables were considered seperately, all scales of the T-QTI (exccept strict) reach statistical significance.

Table 4.12 MANOVA results for null hypothesis 7.

T-QTI Scales	GENDER	Mean	Std. Error	F	Sig.	Eta squared
DC	Girls	22.78	.384	5.471	.020	.012
	Boys	21.55	.379			
CD	Girls	20.11	.445	6.352	.012	.014
	Boys	18.57	.440			
CS	Girls	23.24	.424	8.646	.003	.019
	Boys	21.52	.419			
SC	Girls	18.26	.311	8.082	.005	.017
	Boys	17.05	.307			
SO	Girls	7.48	.216	21.288	.000	.045
	Boys	8.85	.214			
OS	Girls	10.58	.383	17.431	.000	.037
	Boys	12.76	.379			
OD	Girls	11.14	.311	6.133	.014	.013
	Boys	12.19	.307			
DO	Girls	19.80	.399	2.277	.132	.005
	Boys	20.62	.394			

Girls viewed that their teacher display more leadership, understanding, and helping/friendly behavior and they get more responsibility and freedom than boys viewed. Boys viewed that their techer display more uncertain, admonishing and dissatisfied behavior than do girls.

4.3.9 Null Hypothesis 8

There is no significant difference between the 8th grade students' thought by a malec teacher and those thought by female teachers with respect to students' perceptions of their science teacher interpersonal behavior.

A one-way between groups multivariate analysis of varaince was performed to investigate differences between the 8th grade students' thought by a malec teacher and those thought by female teachers with respect to students' perceptions of their science teacher interpersonal behavior (Table 4.13). There was a significant differences between males and females on the combined dependent variables (the T-WIHIC scales) [F(8,709) = 4.31, p=0.000; Wilk's Lambda = 0.95; partial eta squared =0.05]. When the results of the dependent variables were considered seperately, the only difference to reach statistical significance using Bonferoni adjusted alpha level of 0.005 was strict [F (1, 716) = 15.984, p= 0.00, partial eta squared = 0.022], and alpha level of 0.002 was admonishing behavior [F (1, 716) = 17.631, p = 0.00, partial eta squared = 0.024]. An inspection of the mean scores indicate that students perceived their male teacher slightly higher levels (M = 21.08, SD = 0.32) of strict behavior than females (M = 19.37, SD = 0.28) and students perceived their male teacher slightly higher levels (M = 12.62, SD = 0.25) of admonishing behavior than females (M = 11.25, SD = 0.22). Sudents rated their male teachers that displayed more strict and admonishing behaviors than female teachers.

Table 4.13 MANOVA results for null hypothesis 8.

T-QTI Scales	TEACHER GENDER	Mean	Std. Error	F	Sig.	Eta squared
DC	Female	21.71	.274	0.781	0.38	0.001
	Male	22.07	.314			
CD	Female	19.06	.311	0.079	0.78	0.000
	Male	18.92	.356			
CS	Female	22.42	.308	3.467	0.06	0.005
	Male	21.55	.353			
SC	Female	17.31	.226	1.110	0.29	0.002
	Male	17.67	.258			
SO	Female	8.26	.159	0.018	0.89	0.000
	Male	8.23	.182			
OS	Female	11.60	.270	4.321	0.04	0.006
	Male	12.46	.309			
OD	Female	11.25	.215	17.631	0.00	0.002
	Male	12.62	.246			
DO	Female	19.37	.281	15.984	0.00	0.022
	Male	21.08	.321			

4.4 Summary of the Results

1. Generally, the students perceive a very positive science classroom learning environment in Turkey.
2. There is a positive correlation between students' attitude towards science and students' perception of science learning environment in terms of the T-WIHIC.
3. There is a positive correlation with students' science achievement and students' perception of science learning environment in terms of the T-WIHIC.
4. There is a significant differences between boys and girls perceptions on the learning environment scales; girls rated their learning environment in a more positive way on all of the seven scales of T-WIHIC.
5. The results showed that students viewed science learning environment of their male teachers' classes more cooperative than female teachers' classes.
6. Students perceived that their teachers displayed cooperative behaviors (leadership, helping/friendly, and understanding) rather than opposition behaviors (uncertain, dissatisfied, admonishing, strict) in terms of interaction with them.
7. There is a positive correlation between attitudes towards science and DC, CD, CS, SC scales and a negative correlation between attitudes towards science and SO, OS, OD, DO scales of the T- QTI.
8. There is positive correlation with science achievement and students' perceptions of their science teacher interpersonal behavior in terms of T-QTI scales.

9. There is a significant differences between girl and boy students' perception on interpersonal teacher behavior that girls rated their teacher in a more positive way on four scales; DC, CD, CS and SC of T-QTI.
10. Students rated their male teachers that display more strict and admonishing behaviors than females.

CHAPTER V

CONCLUSION, DISCUSSION AND IMPLICATIONS

This chapter consists of seven sections. First section presents the summary of the research study. The second one is the conclusion based on the results. The third section is the discussion of the results. Internal and external validities of the study are given in the fourth and fifth sections, respectively. The sixth section points out implications of the study, and the last section presents recomendations for further studies.

5.1 Summary of the Research Study

Over the last three decades, researchers in many countries have shown increasing interest in the conceptualization, assessment and investigation of student perceptions of psychosocial dimensions of their learning environment. Teaching in the classroom is a complex task. Many factors (among others emotional, cultural, interpersonal, environmental) influence the teacher, the students and what happens in class (Shuell, 1996). What is happening in a science lesson takes the interest of the many researcher.

In the present study, the relationships between 8 th grade students' perceptions of both their science learning environment and teachers interpersonal behavior, and their associations with students cognitive and affective outcomes were examined. In order to

investigate the specified purposes of the study, 722 eight grade students were administered the Turkish version of Questionnaire on Interpersonal teacher behavior (QTI), What is Happening in This Classroom? (WIHIC) and Science Attitude scale during the second semester of the 2003-2004 year. To obtain the representative sample, convenience sampling was used.

5.2 Conclusions

The results of the current study revealed that generally, the students perceive a very positive science classroom learning environment in Turkey. Furthermore, Turkish secondary school science teachers run their classes with fairly strong leadership, accompanied by a somewhat helping, friendly and understanding behavior, and with fairly strict behavior, but that they do not display uncertain and admonishing behavior.

Results also indicated that there is a relationship between the students' perception of both their science teacher interpersonal behavior and learning environment and their cognitive and affective outcomes. Gender differences were tested in students' perceptions on the two aspects of classroom environment; learning environment and teacher interpersonal behavior. As expected, girls percieved their learning environments in all scales of T-WIHIC and they viewed their teachers display more leardership, helping/friendly, and understanding behaviors of T-QTI than do boys. Lastly, students viewed science learning environment of their male teachers' classes more cooperative than female teachers' classes and students rated their male teachers that display more

strict and admonishing behaviors than females teachers.

5.3 Discusssion of the Results

Haladayna, Olsen, and Shaunghneesy (1982) reported that there are three essential features influence attitude: students, teachers, and learning environment. Student variables involve any indicators which are attributable to the individual students and are not part of a larger context. Teacher variables are indicators that are unique to the individual science teachers. Learning environment variables are descriptive of the context and setting of the instructional programme.

As it is reported in Chapter IV, there is positive correlation between attitude towards science and science learning environment in terms of the T-WIHIC scales. The scales which correlate most strongly with the attitudinal outcomes in this study were teacher support, involvement, equity, and task orientation. In classes where students perceive that they get the high amount of teacher support, that they frequently use investigative methods, that they are on task, and that the class operates equitably, students show a more positive attitude towards their science.

The results support the previous studies. For example according to the results of the study of Margianti, Fraser and Aldridge (2001), all scales of the WIHIC, according to the results of the study of Koul and Fisher (2002), only three scales of the WIHIC namely investigation, task orientation and equity, and according to the results of the study of Rawnsley and Fisher (1998), teacher support, equity, and involvement scales of

the WIHIC were significantly related to students attitude towards science.

The ultimate aim of education is to produce healthy minded productive citizens. This can be achieved through positive attitudes towards learning by creating an enjoyable and productive learning environment. The existing learning environment can be re-inforced by incorporating more positive practices which will give an atmosphere of thriving to students and teachers specifically and ultimately leading us towards a much healthier society (Koul & Fisher, 2002).

Cognitive outcomes were also tested in this study and the analyses of the data indicated a positive correlation with students' cognitive outcomes and science learning environment in terms of the T-WIHIC scales. According to the analysis, the scales which correlate most strongly with the cognitive outcomes in this study were equity, investigation and teacher support. In classes where students perceive that the class operates equitably and that they frequently use investigative methods they get the high amount of teacher support, students show the higher cognitive outcomes. Science achievement scores are the students' previous semester science grades over 5. But the %47 of them didn't write their grades. Teacher grading styles vary from teacher to teacher. These might affect the results.

Similarly, Goh and Fraser (1998) indicated that there are associations between students' perceptions on learning environment using My Class Inventory (MCI) and student cognitive and affective outcomes. Using the Science Laboratory Environment Inventory (SLEI), Henderson, Fisher and Fraser (2000) found that integration scale was likely to promote achievement, whereas rule clarity and an open-endedness were

negatively associated with student achievement in terms of SLEI scales.

Huang (2003) reported that gender is a key predictor of learning environment. Khoo and Fraser (1997) indicated that the boys perceived greater involvement, while girls perceived more equity. Result of the present study indicated that girls held somewhat better perceptions of classroom learning environment than did boys on all scales of the T-WIHIC. With regard to this finding, teachers should learn how to enhance the teaching atmosphere in order to provide more support to boys. Teacher gender were also tested. The results indicated that male teachers' classes were rated more cooparetive than female teachers' class by the students.

When the interpersonal teacher behavior examined, it was seen that students perceived that their teachers displayed cooperative behaviors (leadership, helping/friendly, and understanding) rather than opposition behaviors (uncertain, dissatisfied, admonishing) in terms of interaction with them in Turkey. Turkish secondary school science teachers run their classes with fairly strong leadership, accompanied by a somewhat helping, friendly and understanding behavior, and with fairly strict behavior, but that they do not display uncertain and admonishing behavior. It also reminds us of the fact that Turkish secondary school teachers normally depend on lecturing rather than any other teaching strategies. According to Lee and Fraser (2001) found that the science teachers are directive, strict and not supportive of students' self-activities in Korea. Similarly, Rickards, Fisher, and Fraser (1996) indicated that Korean high school science teachers run their classes with fairly strong leadership, helping, friendly and understanding attitude, but that they do not display harsh and admonishing

behaviour.

As indicated in the Chapter IV, the scales of QTI; namely leadership, (DC) helping/friendly, (CD), understanding, (CS), and student responsibility/freedom, (SC) each were related positively to students' attitudes towards the science classes. Conversely the remaining four scales of uncertain, dissatisfied, admonishing and strict behaviours each were related negatively to attitudes. The results showed that the more positive the attitude of the students, the higher the his or her perception of the teacher in terms of both influence and proximity. This is consistent with the findings reported with students in The Netherlands and the USA (Wubbels, Brekelmans & Hooymayers, 1991, Brekelmans, Levy & Rodriguez, 1993, Den Brok, 2001, Brekelmans, Wubbels & Den Brok, 2002, Scott, Den Brok & Fisher, 2004, Den Brok, Fisher, & Rickards, 2004). These previous studies indicated that when students perceive strong behaviour typified by the behaviour on the right of the vertical axis in the circumplex model, i.e. in the cooperative part of the Proximity axis, there is a high correlation with development of positive attitudes. Strong behaviour on the left of the vertical axis was shown to have a negative correlation with the development of positive attitudes.

Variations in the students' attitudes toward the subject and the lessons have been characterized on the basis of the proximity dimension: the more cooperative the behavior displayed, the higher the affective outcome scores (Wubbels, Brekelmans, & Hooymayers, 1991). That is, student responsibility and freedom, understanding, helping/friendly and leadership behaviors were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviors were related negatively to

student attitudes. A similar pattern exists with cognitive achievement with the addition that strict or controlling behaviors are positively associated with cognitive outcomes. (Wubbels, Brekelmans, & Hooymayers, 1991).

The result of this research about relationships between attitude and QTI scales supports the previous studies. As Wubbels, Brekelmans, and Hooymayers (1991) reported that the more cooperative the behavior displayed by teacher, the higher the students affective outcome scores, that is, leadership (DC), helping/friendly (CD), understanding (CS) and student responsibility and freedom (SC) behaviors were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviors were related negatively to student attitudes. The results of the studies of Scott, Den Brok and Fisher (2004) and Rickards and Den Brok (2003) indicated strong and positive effects of Influence and Proximity on students' enjoyment of their science class.

In numerous studies of relationships between teacher behaviour and student outcomes (Wubbels and Brekelmans, 1998), medium to strong associations have been found, but relationships are stronger for affective than cognitive outcomes. Whereas leadership, helpful/friendly and understanding behaviours are positively related to student outcomes, uncertain, dissatisfied and admonishing behaviours are negatively related to outcomes. Brekelmans and Créton (1993) found that teachers' dominant behaviour intensifies during the first ten years of teaching and stabilises after this time; on the other hand, cooperative behaviour remains consistent throughout the entire teaching career.

The relationship between students' science achievement and teacher behavior were tested using simple correlation analysis and multiple regression analysis. Simple correlation analysis showed that there is small correlation with students' science achievement and all the T-QTI scales in Turkey. Leadership, helping/friendly, understanding, and student responsibility scales had positive correlation, while uncertain, dissatisfied, admonishing, and strict scales had negative correlation with students' science achievement. The highest positive correlation was between students responsibility/freedom and the highest negative correlation was between dissatisfied scale. Standardised regression coefficient (□) were generally low. The highest one is for understanding and student responsibility scales on the T-QTI.

The result of this research about relationships between students' science achievement and teacher behavior supports some of the findings of Henderson, Fisher and Fraser (2000) found that the teacher's strong leadership, provision of a degree of student responsibility and freedom were likely to promote achievement, whereas a greater degree of strict behavior by the teacher, were negatively associated with student achievement. Wubbles et al. (1991) investigated the relationships between perceptions on the QTI scales and student learning outcomes in The Netherlands. They found that regarding students' cognitive outcomes, the more that teacher demonstrated strict, leadership and helping/friendly behavior, the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviors were related negatively to achievement.

Rawnsley and Fisher (1998) indicated that students showed the greatest cognitive gains in classes where students perceived that the teacher emphasized understanding the work. The least cognitive gains occurred in classes where students perceived that the teacher was dissatisfied, gave them too much freedom and responsibility, and where they were involved in investigations.

Research investigating the association between students' achievement and their perceptions of teacher behavior is also inconclusive, showing significant but weak effects when report card grade is used as an indicator. Levy et al. (1992) found that report card grades were positively related to influence and proximity, but the same researchers were not able to replicate this finding in a later study (Levy et al., 1997). Research using cognitive test scores and treating students' perceptions as the independent rather than the dependent variable did find consistent and positive relationships between achievement and influence and proximity.

Perceptional differences of interpersonal teacher behavior between genders were also tested and significant differences were detected between genders on six of the eight scales of the QTI, namely leadership, admonishing, understanding, dissatisfied, and uncertain behaviors. Girls rated their teacher more favorably on the DC, CD, and CS scales and less favorable on the OD, OS, and SO scales than do boys.

Goh and Fraser (1996) indicated that in relation to boys, girls consistently rated their teacher interpersonal behavior in a more positive way. In other words, girls rated more highly their teachers' understanding and helping/friendly behaviors and less highly their uncertain, dissatisfied, and admonishing behaviors in elementary schools. Fisher,

Fraser, and Rickards (1996, 1997) argued that girls perceive their teachers in a more positive way than do boys. The results of the previous reseraches were similar with the present study on QTI.

Students within a class see their classroom environment-either learning environment or interpersonal teacher behavior-relatively similarly, and that average class perceptions vary from class to class. A series of analyses of variance, with class membership as the main effect, revealed significant differences ($p < 0.01$) for every QTI scale between the perceptions of students in different classes. The causes of the differences in within-class perception were presented by Levy, Den Brok, Wubbels, and Brekelmans (2003). The first cause is, systematic differences could occur with respect to specific characteristics of students, teachers or classes. For example, girls could view teachers differently than boys, or teachers could pay more attention to one group than the other. Differences in students' opinions have been associated with variables such as student and teacher gender, student and teacher ethnic background, grade level, teacher experience, subject (Den Brok et al., 2002, Wubbels & Levy, 1993).

Second, they could be the result of differences in teacher treatment. While this would be unsurprising at the individual level, it is clear that some teachers do treat students differently depending on their students' and their own gender and/or ethnic background (e.g. Casteel, 1996, Irvine, 1985, 1986, Simpson & Erickson, 1983). Kuklinsk and Weinstein (2000) reported that children were able to perceive that there were different learning environments within the same classroom for high-achieving students compared with low-achieving students. Third, within-class perceptual

differences could be the result of varying needs and expectations that students have with respect to the teacher. Some students, for example, could have lower self-esteem than others and therefore need a teacher who is overly supportive. These students could project this need onto their teachers, resulting in different interpretations than other students of the same behavior. Finally, within-class differences could be caused by dissimilar values and norms used by students to assess their teachers. Some students could regard a teacher who repeatedly checks for understanding as helpful, for example, while others might see this as intrusive.

Analysis of association between teacher gender and teacher interpersonal behavior indicated that there is a differences between the students' perception on female and male teacher interpersonal behavior that; students rated their male teachers that displayed more strict and admonishing behaviors than female teachers. There have been a limited number of studies about affects of teacher gender on students' perceptions of interpersonal teacher behavior. Using the Questionnaire on Teacher Interaction (QTI) in the U.S. and The Netherlands, Den Brok, Fisher, and Rickards (2004) indicated that in those countries, several factors affect student's perceptions. These include student and teacher gender, student and teacher ethnic background, student age, teacher experience, class size, student achievement and subject.

Overall, this study made several distinctive contributions to the field of learning environment research in Turkey. This study provided some information about adaptation and the validation of the widely-applicable Questionnaire on Teacher Interaction (QTI) for use in Turkey. Therefore, this instrument can be used for further research. By using

two learning environment instruments within the same study (the T-QTI and T-WIHIC), it was possible to ascertain the unique and joint contributions of each instrument to student outcomes, therefore providing insights into the usefulness of including both instruments together in future research.

This study adds to the groving body of research into the learning environments, as well as the begining of learning environment specifically in Turkey. Students perceived science learning environment that has more teacher support, student cohesiveness, task orientation, investigation, cooperation and equity. This means that students in Turkey consistently viewed their classroom environment (in terms of the seven scales of the T-WIHIC) favorably. Therefore, for the sake of improving the teaching and learning process, classroom teacher could use this information to enhance their service to students.

5.4 Internal Validity of the Study

Internal validity of the study refers to the degree to which the observed differences on the dependent variables are directly related to the independent variables, not to extraneous variables that may affect the results of the research (Fraenkel and Wallen, 1996). Possible threats to internal validity and methods to cope with them were discussed in this section.

The schools are selected in a convenience manner rather than randomly selected. Location and instrumentation could not be threats to the study since the instruments

were administered to all groups in similar conditions. Data collector characteristics and data collector bias threats were assumed to be controlled by training and informing the teachers to ensure Standard procedures under which data were collected. Finally confidentially was not a possible threat for this study since names of the students were not collected and used anywhere.

5.5 External Validity of the Study

Since all the administration procedure took place in ordinary classroom during regular class hours, there were possibly no remarkable differences among environmental conditions. Therefore, it was believed that external effects were sufficiently controlled by the setting used in the study.

5.6 Implications of the Study

Based on the findings of this study and previous research following suggestions can be offered:

- Teachers wishing to improve students' affective outcomes should include lessons that allow for more student cohesiveness, teacher support, task orientation, equity, involvement and investigation.

- Teachers wishing to improve students' cognitive outcomes should include lessons that allow for more student cohesiveness, teacher support, task orientation, equity, involvement and investigation.
- Teachers wishing to improve students' affective outcomes should include lessons that allow for more student responsibility and freedom, understanding, helping/friendly and leadership behaviors and less uncertain, dissatisfied, admonishing and strict behaviors.
- Teachers wishing to improve students' cognitive outcomes should include lessons that allow for more student responsibility and freedom, understanding, helping/friendly and leadership behaviors and less uncertain, dissatisfied, admonishing and strict behaviors.
- Teachers should learn how to enhance the teaching atmosphere in order to provide more support to boys.

5.7 Recommendations for Further Researches

Current study has suggested a variety of useful topics for further studies. These are briefly as follows:

- Future research can examine the differences between the actual and the preferred science learning environment.
- Future research can examine the effects of age on student perception of learning environment and interpersonal teacher behavior

- Differences between students and teachers perceptions on learning environment and interpersonal teacher behavior can be examined.
- Science laboratory environment can be investigated.
- Qualitative studies can be conducted.

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APPENDIX A

T-WIHIC

Aşağıda Fen Bilgisi sınıfının genel atmosferi ile ilgili 41 soru yer almaktadır. Belirtilen ifadelere ne derecede katıldığınızı ya da katılmadığınızı ilgili kutucuğu tamamen doldurarak belirtiniz.

1= Hiç bir zaman 2= Çok az 3= Bazen 4= Sık sık 5= Her zaman

	Hiç bir zaman	Çok az	Bazen	Sık sık	Her zaman
1. Sınıfımdaki öğrencilerle yakın arkadaşlık kurarım.	1❑	2❑	3❑	4❑	5❑
2. Sınıfımdaki diğer öğrencileri yakından tanıyorum.	1❑	2❑	3❑	4❑	5❑
3. Bu sınıftaki öğrencilerle uyum içindeyim.	1❑	2❑	3❑	4❑	5❑
4. Sınıftaki herkes arkadaşımdır.	1❑	2❑	3❑	4❑	5❑
5. Bu sınıftaki diğer öğrencilerle birlikte çalışırım.	1❑	2❑	3❑	4❑	5❑
6. Sınıftaki diğer öğrenciler beni severler.	1❑	2❑	3❑	4❑	5❑
7. Öğretmen benimle kişisel olarak ilgilenir.	1❑	2❑	3❑	4❑	5❑
8.Öğretmen benim duygularımı dikkate alır.	1❑	2❑	3❑	4❑	5❑
9. Öğretmen, dersle ilgili bir problemim olduğunda bana yardımcı olur.	1❑	2❑	3❑	4❑	5❑
10. Öğretmen benimle diyalog kurar.	1❑	2❑	3❑	4❑	5❑

11. Öğretmen benim problemlerimle ilgilenir.	1❑	2❑	3❑	4❑	5❑
12. Öğretmen sorduğu sorularla konuları kavramama yardımcı olur.	1❑	2❑	3❑	4❑	5❑
13. Sınıfta fikirlerimi rahatlıkla tartışabilirim.	1❑	2❑	3❑	4❑	5❑
14. Sınıf tartışmalarında fikirlerimi rahatça söyleyebilirim.	1❑	2❑	3❑	4❑	5❑
15. Fikirlerim ve önerilerim sınıf tartışmalarında kullanılır	1❑	2❑	3❑	4❑	5❑
16. Öğretmene sorular sorarım.	1❑	2❑	3❑	4❑	5❑
17. Diğer öğrencilere fikirlerimi açıklarım.	1❑	2❑	3❑	4❑	5❑
18. Fikirlerimin doğruluğundan emin olmak için araştırmalar yaparım.	1❑	2❑	3❑	4❑	5❑
19. Tartışmalarda ortaya çıkan problemleri çözmek için araştırmalar yaparım.	1❑	2❑	3❑	4❑	5❑
20. Söylenen ifadelerin, şekillerin ve grafiklerin anlamını açıklarım.	1❑	2❑	3❑	4❑	5❑
21. Kafamı karıştıran konuları cevaplayabilmek için araştırmalar yaparım.	1❑	2❑	3❑	4❑	5❑
22. Öğretmenin sorularını cevaplamak için araştırmalar yaparım.	1❑	2❑	3❑	4❑	5❑
23. Araştırmalar yaparak soruların cevaplarını bulmaya çalışırım.	1❑	2❑	3❑	4❑	5❑

24. Çalışabildiğim kadar çalışırım.	1❑	2❑	3❑	4❑	5❑
25. Bu dersin amaçlarını biliyorum.	1❑	2❑	3❑	4❑	5❑
26. Bu sınıfta neyi başarmak için çabaladığımı biliyorum.	1❑	2❑	3❑	4❑	5❑
27. Ders sırasında dikkatimi toparlamaya çalışırım.	1❑	2❑	3❑	4❑	5❑
28. Sınıftaki yapılan çalışmaları anlamaya çalışırım.	1❑	2❑	3❑	4❑	5❑
29. Ne kadar çalışmam gerektiğini bilirim.	1❑	2❑	3❑	4❑	5❑
30. Ödevlerimi yaparken diğer öğrencilerle işbirliği yaparım.	1❑	2❑	3❑	4❑	5❑
31. Ödevlerimi yaparken arkadaşlarımla kitap ve kaynaklarımı paylaşırım.	1❑	2❑	3❑	4❑	5❑
32. Sınıfta grup çalışmaları yapılırken iş bölümü yapılır.	1❑	2❑	3❑	4❑	5❑
33. Sınıfta verilen projelerde diğer öğrencilerle çalışırım	1❑	2❑	3❑	4❑	5❑
34. Sınıftaki diğer öğrencilerden öğrendiğim şeyler olur.	1❑	2❑	3❑	4❑	5❑
35. Sınıf içi faaliyetlerde diğer öğrencilerle işbirliği yaparım.	1❑	2❑	3❑	4❑	5❑
36. Öğretmen sınıftaki diğer öğrencilerin verdiği cevaplara gösterdiği dikkati, benim cevaplarıma da gösterir.	1❑	2❑	3❑	4❑	5❑
37. Sınıftaki diğer öğrencilerle aynı derecede söz hakkı alırım	1❑	2❑	3❑	4❑	5❑
38. Bana sınıftaki diğer öğrencilerle aynı biçimde davranılır.	1❑	2❑	3❑	4❑	5❑

39. Sınıftaki diğer öğrencilerle aynı derecede öğretmenden destek alırım. 1❑ 2❑ 3❑ 4❑ 5❑

40. Sınıf tartışmalarına katılmak için diğer öğrenciler ile aynı fırsatı elde ederim. 1❑ 2❑ 3❑ 4❑ 5❑

41. Çalışmalarım sınıftaki diğer öğrencilerle aynı miktarda takdir edilir. 1❑ 2❑ 3❑ 4❑ 5❑

Teşekkür Ederiz.

APPENDIX B

T-QTI

Bu bir test değildir. Bu ölçekte fen bilgisi öğretmeninizin davranışlarını tanımlamanız isteniyor. Öğrenmek istediğimiz sizin görüşlerinizdir. Bu ölçek 47 cümleden oluşmaktadır. Belirtilen ifadelere ne derecede katıldığınızı ya da katılmadığınızı ilgili kutucuğu tamamen doldurarak belirtiniz.

Fen bilgisi öğretmenim	Hiç bir zaman	Nadiren	Ara sıra	Sıklıkla	Her Zaman
1- Serttir.	1❑	2❑	3❑	4❑	5❑
2- Kararsız görünür	1❑	2❑	3❑	4❑	5❑
3- Dersinde biz de bazı şeyler hakkında karar verebiliriz.	1❑	2❑	3❑	4❑	5❑
4- Dersi zevk alarak anlatır.	1❑	2❑	3❑	4❑	5❑
5- Onun dersinde sesiz olmak zorundayız.	1❑	2❑	3❑	4❑	5❑
6- Tereddüt eder.	1❑	2❑	3❑	4❑	5❑
7- Bizden etkilenebilir.	1❑	2❑	3❑	4❑	5❑
8- Konuları açık bir şekilde ifade eder.	1❑	2❑	3❑	4❑	5❑
9- Ders için bizden çok şey bekler.	1❑	2❑	3❑	4❑	5❑
10- Derste, dersle ilgisiz davranışlarda bulunduğumuzda ne yapacağını bilemez.	1❑	2❑	3❑	4❑	5❑

11- Bize en ilginç gelen konuları ödev olarak seçebilme şansına sahibiz.	1❑	2❑	3❑	4❑	5❑
12- Sınıfta olan biten her şeyi bilir.	1❑	2❑	3❑	4❑	5❑
13- Sınavları zordur.	1❑	2❑	3❑	4❑	5❑
14- Onu kandırmak kolaydır.	1❑	2❑	3❑	4❑	5❑
15- Çalıştığımız konuda bize seçenekler sunar.	1❑	2❑	3❑	4❑	5❑
16- İyi bir liderdir (önderdir).	1❑	2❑	3❑	4❑	5❑
17- Eğer ödevlerimizi yapmamışsak dersine girmekten korkarız.	1❑	2❑	3❑	4❑	5❑
18- Çekingendir.	1❑	2❑	3❑	4❑	5❑
19- Sınıfta bize bolca boş zaman verir.	1❑	2❑	3❑	4❑	5❑
20- Kendine güvenir biçimde hareket eder.	1❑	2❑	3❑	4❑	5❑
21- Yazılı kağıtlarını değerlendirirken notu kıttır.	1❑	2❑	3❑	4❑	5❑
22- Hoşgörülüdür.	1❑	2❑	3❑	4❑	5❑
23- Biz kendisinden çok şey öğreniriz.	1❑	2❑	3❑	4❑	5❑
24- Ondan korkarız.	1❑	2❑	3❑	4❑	5❑
25- Çalışmalarımızda bize yardımcı olur.	1❑	2❑	3❑	4❑	5❑
26- Bizi cezalandırmakla tehdit eder.	1❑	2❑	3❑	4❑	5❑
27- Bize güvenir.	1❑	2❑	3❑	4❑	5❑
28- Çabuk sinirlenir.	1❑	2❑	3❑	4❑	5❑
29- Bizimle kişisel olarak ilgilenir.	1❑	2❑	3❑	4❑	5❑

30- Bizim hiç bir şey bilmediğimizi düşünür.	1❑	2❑	3❑	4❑	5❑
31- Gerektiğinde konuları tekrar anlatmaya isteklidir.	1❑	2❑	3❑	4❑	5❑
32- Hata yaptığımızda düzeltmemize fırsat vermeden uyarır.	1❑	2❑	3❑	4❑	5❑
33- Arkadaşça davranır.	1❑	2❑	3❑	4❑	5❑
34- Bizi aptal durumuna düşürmeye çalışır.	1❑	2❑	3❑	4❑	5❑
35- İstediğimiz takdirde yardım etmeye gönüllüdür.	1❑	2❑	3❑	4❑	5❑
36- Sabırsızdır.	1❑	2❑	3❑	4❑	5❑
37- Güvenebileceğimiz bir kişidir.	1❑	2❑	3❑	4❑	5❑
38- Mutsuzdur.	1❑	2❑	3❑	4❑	5❑
39- Söyleyecek bir şeyimiz varsa, bizi dinler.	1❑	2❑	3❑	4❑	5❑
40- Öfkeli biridir.	1❑	2❑	3❑	4❑	5❑
41- Mizah (espri) anlayışı vardır.	1❑	2❑	3❑	4❑	5❑
42- Bizi küçümser.	1❑	2❑	3❑	4❑	5❑
43- Bizi anlar.	1❑	2❑	3❑	4❑	5❑
44- Alaycıdır.	1❑	2❑	3❑	4❑	5❑
45- Şaka kaldırır.	1❑	2❑	3❑	4❑	5❑
46- Şüphecidir.	1❑	2❑	3❑	4❑	5❑
47- Sabırlıdır.	1❑	2❑	3❑	4❑	5❑

APPENDIX C

FEN BİLGİSİ DERSİ TUTUM ÖLÇEĞİ

Bu ölçek, Fen bilgisi dersine ilişkin tutum cümleleri ve her cümlenin karşısında sizin düşüncenizi ölçen beş seçenek içermektedir. Lütfen her cümleyi dikkatle okuduktan sonra kendinize uygun seçeneği işaretleyiniz.

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle katılmıyorum
1. Fen bilgisi çok sevdiğim bir alandır.	1❑	2❑	3❑	4❑	5❑
2. Fen bilgisi ile ilgili kitapları okumaktan hoşlanırım.	1❑	2❑	3❑	4❑	5❑
3. Fen bilgisinin günlük yaşantıda çok önemli bir yeri yoktur.	1❑	2❑	3❑	4❑	5❑
4. Fen bilgisi ile ilgili ders problemlerini çözmekten hoşlanırım.	1❑	2❑	3❑	4❑	5❑
5. Fen bilgisi konuları ile ilgili daha çok şey öğrenmek	1❑	2❑	3❑	4❑	5❑
6. Fen bilgisi dersine girerken sıkıntı duyarım.	1❑	2❑	3❑	4❑	5❑

7. Fen bilgisi derslerine zevkle girerim.	1❑	2❑	3❑	4❑	5❑
8. Fen bilgisi dersine ayrılan ders saatinin daha fazla olmasını isterim.	1❑	2❑	3❑	4❑	5❑
9. Fen bilgisi dersine çalışırken canım sıkılır.	1❑	2❑	3❑	4❑	5❑
10. Fen bilgisi konularını ilgilendiren günlük olaylar hakkında daha fazla bilgi edinmek isterim.	1❑	2❑	3❑	4❑	5❑
11. Düşünce sistemimizi geliştirmede Fen bilgisi öğrenimi önemlidir.	1❑	2❑	3❑	4❑	5❑
12. Fen bilgisi çevremizdeki doğal olayların daha iyi anlaşılmasında önemlidir.	1❑	2❑	3❑	4❑	5❑
13. Dersler içinde Fen bilgisi dersi sevimsiz gelir.	1❑	2❑	3❑	4❑	5❑
14. Fen bilgisi konuları ile ilgili tartışmalara katılmak bana cazip gelmez.	1❑	2❑	3❑	4❑	5❑
15. Çalışma zamanımın önemli bir kısmını Fen bilgisi dersine ayırmak isterim.	1❑	2❑	3❑	4❑	5❑